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Review and Analysis of the 1987 Chum Salmon Season in the Johnstone Strait to Fraser River Study Area

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by

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CONTENTS

	Page
LIST OF FIGURES	iv
LIST OF TABLES	iv
LIST OF APPENDICES	v
ABSTRACT	vi
RÉSUMÉ	vii
INTRODUCTION	1
MANAGEMENT OBJECTIVES AND STRATEGIES FOR 1987	1
AREA-SPECIFIC STRATEGIES	5
Johnstone Strait Strategy	5
Fraser River Strategy	8
Mid Vancouver Island Area Strategy	8
Strategy for Other Terminal Areas	9
DOMESTIC CATCH ALLOCATION	9
PRE-SEASON EXPECTATIONS AND FISHING PLANS	9
IN-SEASON STOCK ESTIMATES AND ACTUAL FISHERY CATCHES	12
COMMERCIAL AND TEST FISHERIES	12
Johnstone Strait In-Season Stock Estimates	12
Commercial fishery	12
Test fishery	14
Johnstone Strait Fishery Catches	14
Commercial catches	14
Test fishing catches	16
Fraser River	16
In-season test fishing stock estimates	16
Fishery catches	21
Mid Vancouver Island	21
In-season stock estimates	21
Qualicum fishery catches	21
Nanaimo and Cowichan Terminal Fisheries	21
Other Fisheries	23
INDIAN FOOD FISHERIES	23
AMERICAN FISHERIES	23
POST-SEASON ANALYSIS AND EVALUATION	26
FISHERY REVIEW	26
ESCAPEMENT SUMMARY	29
TOTAL STUDY AREA STOCK	31
Migration Timing Through Johnstone Strait	31
Fraser River Chum Returns	35
Mid Vancouver Island Chum Returns	35
CLOCKWORK EVALUATION	35
Catch Estimation	39
Stock Assessment	39
Harvest Rate	39
CATCH ALLOCATION	41
AGE ANALYSIS	41
GENETIC STOCK IDENTIFICATION	41
SUMMARY	52
ACKNOWLEDGEMENTS	53
REFERENCES	54
APPENDICES	55

LIST OF FIGURES

Figure

1. The Study Area and stock groupings used in management 2
2. Statistical area map of southern British Columbia and adjacent waters 3
3. Statistical sub-area map of Strait of Georgia 10
4. Weekly chum stock composition in the upper Johnstone Strait chum test fishery, 1987 34

LIST OF TABLES

Table

1. Definition of key terms used in managing the Study Area chum salmon 4
2. Clockwork harvest rate schedule for chum stocks entering Johnstone Strait, 1987-1990 7
3. Pre-season expectations of Study Area chum run size in 1987 11
4. In-season assessment of total Clockwork chum run through Johnstone Strait, 1987 13
5. Weekly commercial chum catch in the Study Area fisheries for all gear, 1987 15
6. Allocation of the commercial chum catch in the Study Area by gear, 1987 17
7. Weekly chum test fishery catch and effort in upper, mid and lower Johnstone Strait and in Juan de Fuca Strait, 1987 18
8. Johnstone Strait seine test fishery in Area 12, 1987 19
9. Pre-season and weekly in-season estimates of Study Area chum stock size, 1987 20
10. Annual Fraser River chum test fishery catch and catch per unit effort, 1963-1987 22
11. Indian food fishery catch of chum salmon by Statistical Area, 1960-1987 24
12. U.S. fisheries chum catch in Juan de Fuca Strait, San Juan Islands and Point Roberts, and estimated Canadian stock component, 1960-1987 25
13. Study Area chum catch, escapement and total stock, 1960-1987 . . . 27
14. Escapements of Study Area chum salmon, 1970-1987 30
15. Comparison of pre-season and in-season estimates of Study Area chum returns with actual (post-season) returns, 1969-1987 . . 32

LIST OF TABLES (cont'd)

Table

16. Production of wild and enhanced Study Area chum salmon since 1955 33

17. Harvest, escapement and harvest rate of Fraser River origin chum salmon, 1951-1987 36

18. Enhanced Mid Vancouver Island chum stock catches in Areas 12-14, escapements, total stock and harvest rates, 1978-1987 37

19. Clockwork assessment of in-season and post-season estimates, and the estimated and desired wild escapements, 1983-1987 38

20. Annual non-reported, test and sampled catches for Areas 14, 17 and 18, 1981-1987 40

21. Weekly age composition of chum stock in Johnstone Strait (Area 12), based on scale analysis of test fishing samples, 1987 . 42

22. Weekly age composition of chum stock in Johnstone Strait (Area 13), based on scale analysis of test fishing samples, 1987 . 43

23. Age composition of the Study Area chum stocks, 1958-1987 44

24. Weekly chum stock composition in 1987 for

    a. Johnstone Strait (Areas 11-13) seine test fishery 46

    b. Mid Vancouver Island (Area 14) commercial fishery 47

    c. Strait of Georgia (Area 17) commercial gillnet fishery 48

    d. Juan de Fuca Strait (Area 20) seine test fishery 49

    e. Nitinat (Area 21) commercial fishery 50

    f. West Coast Vancouver Island test and commercial troll fisheries 51

LIST OF APPENDICES

Appendix

A. Fraser River chum salmon harvest management plan, 1987 56

B. Mid Vancouver Island chum salmon management plan, 1987 63

C. Weekly gear counts and days open in Areas 11-14, 16-18 and 20, 1987 64

D. Weekly days open, gear counts and management regulations for fall chum fisheries in the Study Area, 1987 65

E. Review of Bute Inlet commercial net fisheries, 1970-1987 67

F. Escapement of fall run Study Area chum salmon by system 81

ABSTRACT

Gould, A.P., W.H. Luedke, M.K. Farwell and L. Hop Wo. 1991. Review and analysis of the 1987 chum salmon season in the Johnstone Strait to Fraser River Study Area. Can. Manuscr. Rep. Fish. Aquat. Sci. 2107 : 87 p.

The 1987 chum salmon fishing season in the Johnstone Strait, Strait of Georgia and Fraser River Study Area is reviewed and analyzed. Management in the Johnstone Strait fishing area followed the Clockwork Management Plan and advice from the South Coast Advisory Committee. Terminal fishing areas, including the Fraser River, were managed by stock/area specific plans. Catch by each gear type followed an allocation of 65:35 between seine:gillnet, as specified by the Minister's Advisory Committee.

A harvest rate of 10% or less was prescribed by the Clockwork in 1987, in response to the final in-season Clockwork stock estimate of 2.3 million chum; this was based on the Johnstone Strait commercial assessment and test fishing results. Consequently, the commercial harvesting in Johnstone Strait in 1987 was restricted to a single assessment fishery.

The total catch of the Study Area chum in 1987 was 665,000 (excluding the U.S. origin chum). Its major component was the Study Area commercial catch of 446,000 dominated by the Qualicum terminal fishery (353,000 chum) and the Johnstone Strait fishery (68,400 chum). The remaining Study Area commercial catch came from the Nanaimo, Cowichan and Fraser River areas. Other fisheries which harvested some component of the Study Area chum salmon included the Indian food fisheries and the fisheries in outside regions (Areas 20 and 21, and U.S. Areas).

The post-season estimate of the total Study Area chum stock was 2.07 million of which 1.4 million (69%) was escapement. This escapement was below the interim escapement goal of 2.0 million. The post-season estimate of the Fraser River chum stock was 575,000 of which 430,000 (75%) was escapement. This was below the spawning requirement of 700,000 for the river.

The post-season estimate of the total Study Area chum stock (2.07 million) was below the pre-season estimate of 3.1 million and below the in-season estimate of 2.3 million. The Fraser River post-season stock estimate of 575,000 chum was below the pre-season estimate of 951,000 chum but closer to the in-season estimate of 622,000 chum.

The post-season estimate of the Clockwork harvest rate was 8.8% which was comparable to the in-season estimate of 7.6%. Allocation of commercial chum catch by gear type showed 58% seine and 42% gillnet catch. The age composition of the Study Area chum was 11% age three, 76% age four and 13% age five.

RÉSUMÉ

Gould, A.P., W.H. Luedke, M.K. Farwell and L. Hop Wo. 1991. Review and analysis of the 1987 chum salmon season in the Johnstone Strait to Fraser River Study Area. Can. Manuscr. Rep. Fish Aquat. Sci. 2107 : 87 p.

La saison de pêche 1987 du saumon kéta dans la zone d'étude comprenant le détroit de Johnstone, le détroit de Géorgie et le Fraser est étudiée et analysée. La gestion dans la zone de pêche du détroit de Johnstone s'effectue conformément au Plan de gestion "Clockwork" et aux avis formulés par le Comité consultatif de la côte sud. Les zones de pêche en estuaire, notamment dans le Fraser, on été gérées conformément à des plans particuliers établis par stock et par zone. Les prises pour chaque type d'engin étaient réparties suivant une allocation de 65:35 entre les sennes et les filet maillants, suivant les spécifications du Comité consultatif du Ministre.

Un taux de capture de 10% ou moins a été recommandé, en 1987, dans le plan "Clockwork" en réponse à une estimation finale du stock pendant la saison par le Plan "Clockwork" qui était de 2,3 millions de saumon kéta; ces chiffres étaient fondés sur les résultats de l'évaluation de la pêche commerciale et de la pêche expérimentale dans le détroit de Johnstone. Par conséquent, les prises commerciales dans le détroit de Johnstone, en 1987, étaient limitées à une seule campagne destinées à l'évaluation.

Les prises totales de saumon kéta dans la zone d'étude, en 1987, s'élevaient à 665 000 (en excluant les saumons kétas provenant des États-Unis). La principale composante était les prises commerciales de la zone d'étude qui atteignaient 446 000, et étaient dominées par la pêche dans l'estuaire de la Qualicum (353 000 kétas) et la pêche dans le détroit de Johnstone (68 400 kétas). Les autres prises commerciales de la zone d'étude provenaient des zones de la Nanaimo, de la Cowichan et du Fraser. D'autres pêches qui prélèvent une partie des saumons kétas de la zone d'étude comprenaient la pêche de subsistance des Indiens et la pêche de subsistance des Indiens et la pêche dans les zones extérieures (zones 20 et 21, et les zones américaines).

L'estimation après-saison du stock total de saumon kéta de la zone d'étude était de 2,07 millions dont 1,4 million (69%) provenaient de l'échappée. Cette échappée était inférieure à l'échappée provisoire visée de 2,0 millions. L'estimation après-saison du stock kéta du Fraser était de 575 000 dont 430 000 (75%) provenaient de l'échappée. Ces données étaient inférieures aux besoins en géniteurs évaluée à 700 000 pour la rivière.

L'estimation après-saison du stock total de saumon kéta de la zone d'étude, établis à 2,07 millions, était inférieure à l'estimation avant la saison de 3,1 millions et inférieure à l'estimation de 2,3 millions établie pendant la saison. L'estimation après-saison du stock du Fraser établie à 575 000 kétas était inférieure à l'estimation avant la saison de 951 000 kétas mais s'approchait de l'estimation de 622 000 kétas effectuée pendant la saison.

L'estimation après-saison à 8,8% du taux de capture selon le plan Clockwork était comparable à l'estimation de 7,6% pendant la saison. L'allocation des prises commerciales de saumon kéta par type d'engin était répartie comme suit : 58% par la senne et 42% par les filets maillants. La composition par âge du saumon kéta dans la zone d'étude était de 11% d'âge trois, 76% d'âge quatre et 13% d'âge cinq.

INTRODUCTION

The status of chum salmon stocks returning to the Johnstone Strait - Fraser River Study Area has been reviewed annually since 1961. This report reviews the management of the 1987 chum fisheries in the Study Area and the status of its chum stocks. The Study Area consists of Queen Charlotte Strait, Johnstone Strait, Strait of Georgia and Fraser River regions, and all tributaries. The latter include approximately 120 major spawning streams and, for management purposes, are grouped geographically into 13 sub-areas (Fig. 1). The Study Area is represented by British Columbia Statistical Fishing Areas 11-19, 28 and 29 (Fig. 2). Area 20 (Juan de Fuca Strait) is not included in the Study Area but catches for that region are presented in this report.

Anderson and Beacham (1983) have provided the most recent review of migration patterns and exploitation rates for returning adult chum salmon in the Study Area. These chum stocks migrate primarily through Johnstone Strait between early September and late November. In any given period, the run may consist of many different stocks, with the Fraser River stock complex generally the major contributor. Enhanced chum production from facilities in the Fraser River and Mid Vancouver Island (MVI) areas is contributing a growing share to the annual production. Surplus chum salmon may be harvested in the interception fisheries in Johnstone Strait (Areas 12 and 13), and in terminal fisheries in the Qualicum (Area 14), Nanaimo (Area 17), Cowichan (Area 18) and Fraser River (Area 29) regions, depending on stock abundance.

Management of the Johnstone Strait and Fraser River fisheries is determined by the Clockwork Management Plan. The key elements involved in the management process are defined in Table 1. Only the fall chum catches (i.e. catches after September) are managed by the Clockwork plan, except for the Fraser River (Area 29) where catches throughout the season are included.

This report describes the revisions made to the Johnstone Strait and Fraser River Clockwork management plans for 1987, and reviews the resulting harvest management process and commercial fishery catches. The report also details the 1987 escapement, stock composition, age and migration timing of the Study Area chum. Historical status of these stocks is reviewed and the management strategy is evaluated.

MANAGEMENT OBJECTIVES AND STRATEGIES FOR 1987

Management of the Johnstone Strait and Fraser River commercial fisheries for 1987 was guided by the provisions of the Clockwork management strategy combined with specific catch allocations formulated by the Minister's Advisory Committee (MAC). In-season management decisions were developed in consultation with the South Coast Advisory Committee (SCAC). This is an industry advisory group representing commercial fishermen, processors and sport fishermen from all South Coast areas. The Fraser River Advisory Committee (FRAC) was involved in the management of the Fraser River terminal fishery, while the Mid Vancouver

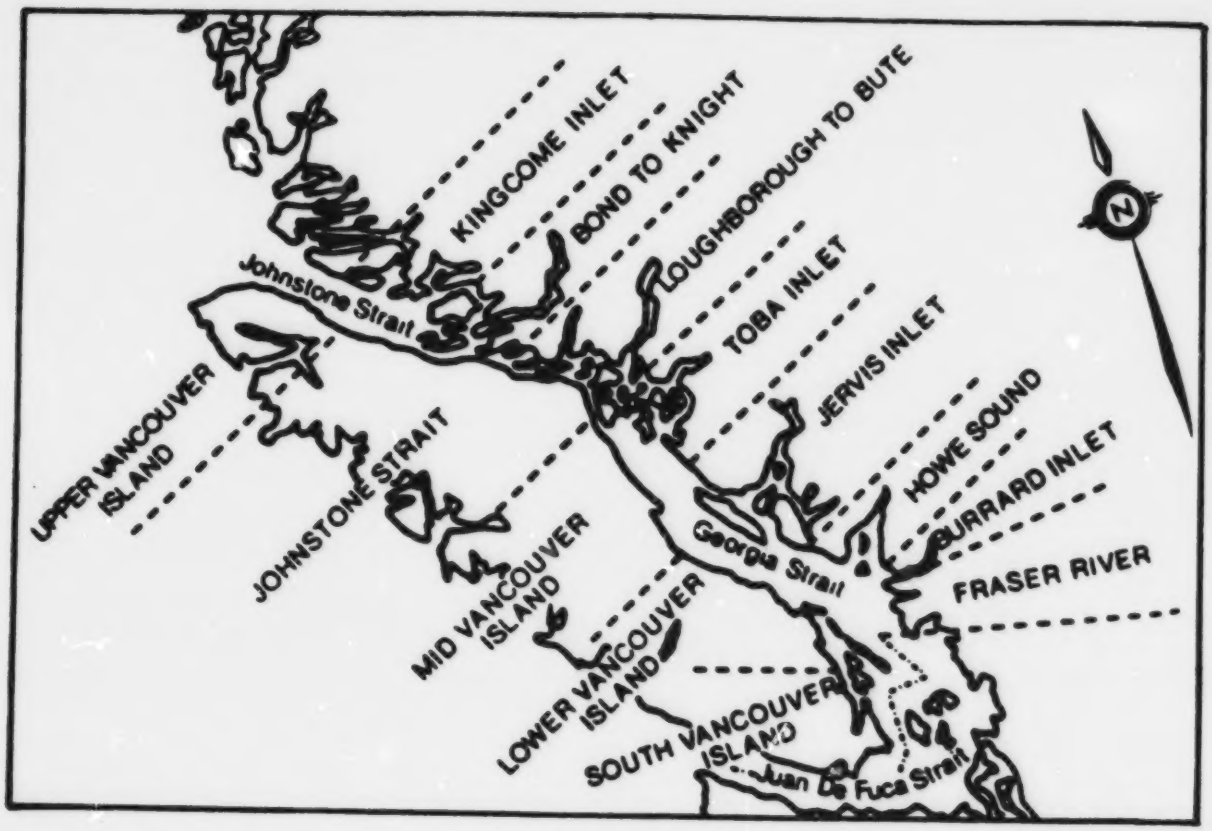

Fig. 1. The Study Area and stock groupings used in management.

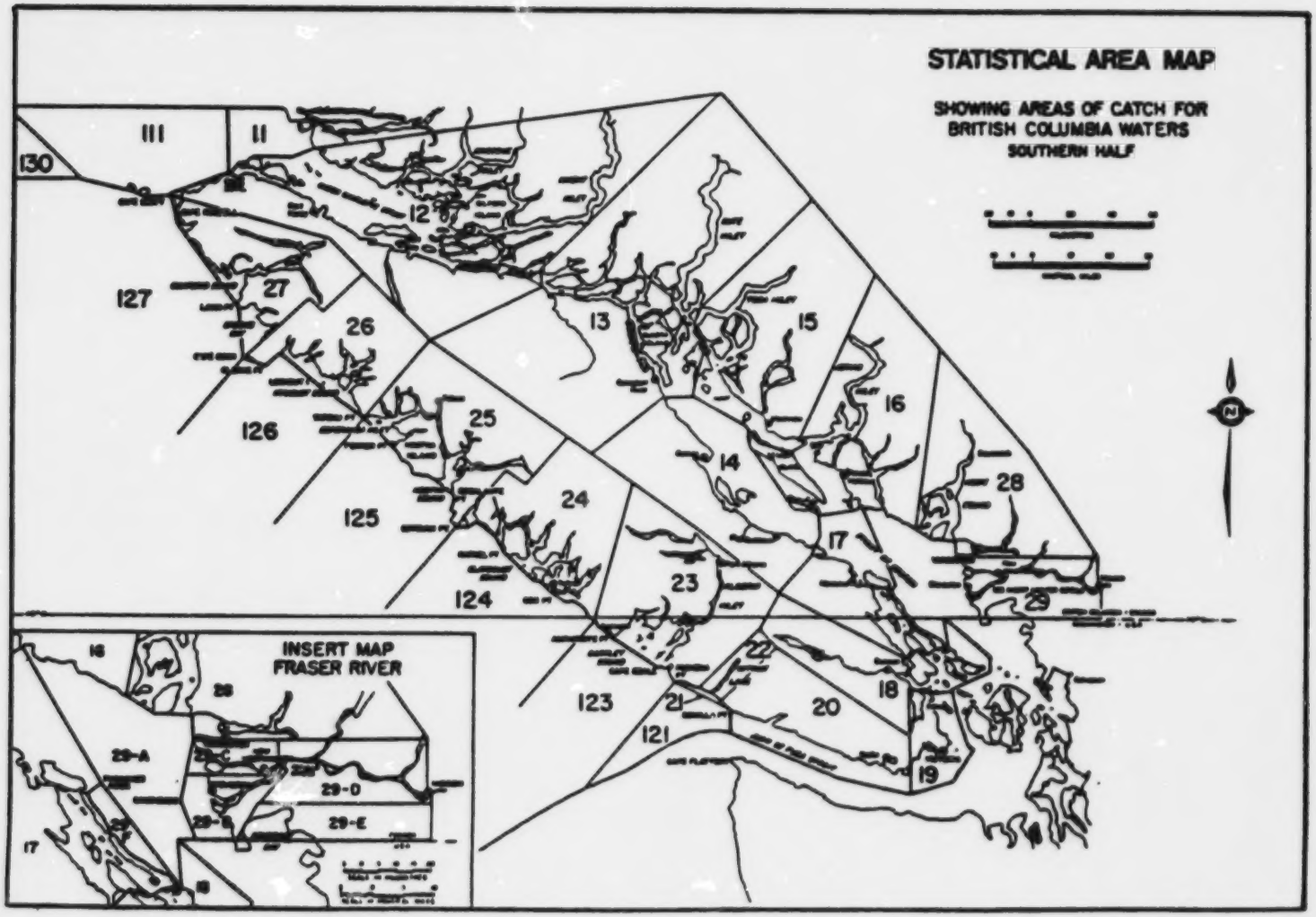

Fig. 2. Statistical area map of southern British Columbia and adjacent waters.

Table 1. Definition of key terms used in managing the Study Area chum salmon(1).

CLOCKWORK ASSESSED CATCH

This catch is a measure of the Clockwork in-season management strategy for the primarily Johnstone Straits fishery. It assesses the estimation of Clockwork Assessed stock size and harvest management.

The Clockwork assessed catch includes all commercial, IFF and test catches in Areas 11-13 and 29, Area 14 Fraser catch component and Canadian catch components in U.S. Areas 7 and 7A.

TOTAL CLOCKWORK CATCH

This catch is assessed by the Clockwork management strategy and includes all Inside chum which migrate through Johnstone Strait:

All commercial catches in Areas 11-19 and 28 (after Sep. 1) and Area 29 (all catch). (Bute Inlet summer run catch excluded.)

\+

Hatchery rack sales

\+

Non-reported catch in Areas 14-19

\+

IFF catches in Areas 11-19 and 28-29

\+

Canadian catch components in U.S. Areas 7 and 7A.

TOTAL STUDY AREA CATCH

This catch includes Total Clockwork Catch and catches of Study Area chum in Outside waters, less U.S. component in Canadian catch:

Total Clockwork Catch

\+

Study Area chum caught in Area 20 (Canadian Juan de Fuca Strait)

\+

Study Area chum caught in Area 21 (Nitinat)

\+

Study Area chum caught in U.S. Areas 4B, 5, 6C, (U.S. Juan de Fuca Strait)

less

U.S. component in Canadian catch

TOTAL CLOCKWORK ASSESSED STOCK

Total Clockwork Catch (above)

\+

Escapement

TOTAL STUDY AREA STOCK

Total Study Area Catch (above)

\+

Escapement

(1) For detailed definitions see Table 13 footnotes.

Island Sub-committee (a sub-committee of the SCAC) was involved in the management of the Qualicum terminal fishery (Area 14).

AREA-SPECIFIC STRATEGIES

Johnstone Strait Strategy

The Clockwork management plan (Gould and Hop Wo 1988, Hilborn and Luedke 1987) was introduced in 1983, and provided a framework for the objectives and strategy by which the Johnstone Strait and Fraser River chum fisheries would be managed. The primary objectives were to rebuild wild chum stocks originating in the South Coast Inside region, to the apparent optimum escapement levels, while providing for limited harvesting of chum stocks in Johnstone Strait in years of substantial returns. The original spawning escapement target of the rebuilding plan was 2.5 million chum spawning in wild areas; this included a minimum escapement of 700,000 wild chum to the Fraser River. An interim wild escapement goal of 1.8 million chum was set for the period 1983-1986. Increasing this interim goal each cycle (4 years) would rebuild the Study Area stock size to the wild escapement target of 2.5 million within 3-4 cycles. In addition, the plan allowed for escapements to be larger than 2.5 million for the South Coast and larger than 700,000 for the Fraser River, in years when stock sizes permitted such an increase. The approach was to determine if greater production could be obtained from escapements exceeding the original target. In order to achieve the above goals, commercial fishing was limited to a variable harvest rate to be set according to the size of the chum run, with a threshold stock size established below which commercial fishing would not occur. The Department of Fisheries and Oceans (DFO) and industry representatives agreed that the Clockwork strategy would be reviewed and revised after each four-year cycle.

The initial stepped harvest rate strategy was developed and implemented for a four-year period, 1983 - 1986. Substantial increases in enhanced production returns each year and the role of the Fraser River fishery were reviewed and the Clockwork strategy modified in the winter of 1987 (Luedke et al. 1988). The major considerations are outlined below.

Enhanced returns of chum salmon to the Study Area have been a component of the total run since the construction of the Big Qualicum River facilities in the early 1960s. This enhanced component has increased from 500,000 in 1983 to a predicted 1,250,000 return in 1987. Since the Clockwork strategy was developed assuming a fixed enhanced yearly component of 700,000 chum, a concern arose that the increased enhanced returns may lead to overharvesting of wild stocks, thereby jeopardising wild stock rebuilding.

The second consideration, prior to the 1987 season, was the Industry concern over the direct linkage of the Johnstone Strait and Fraser River fisheries under a single all encompassing Clockwork plan. The Fraser River fishermen observed that unless a Fraser Clockwork could be developed separately from the Johnstone Strait Clockwork, fishing opportunities in the river could be

lost and benefits from previous conservation efforts in the river would be limited.

To address these and other concerns, several meetings were held in 1987 by the DFO staff along with the South Coast Advisory Committee, to review the development of the objectives in the Clockwork formulation, evaluate the strategy, and develop approaches for revising the Clockwork approach. The review also considered other potential types of harvest strategies that could be employed to achieve rebuilding of wild chum stocks. The Committee, however, maintained their endorsement of the current strategy of a stepped harvest rate. The SCAC did recognise the need to modify the stock sizes required to initiate a specific harvest rate in view of increasing enhanced returns and the need for increased wild escapements. The DFO recommended that the interim wild escapement goal be increased by 200,000 to 2,000,000 chum to ensure that the wild escapement target of 2,500,000 be met within the original time frame of 3-4 cycles. An increase in the enhanced component was also recommended. Although, the enhanced component of the chum run had increased substantially in recent years, it was recognised that a portion of that enhanced stock was escaping to wild spawning areas and contributing to wild stock rebuilding.

Agreement was not unanimous on the level of wild and enhanced stock increases. The SCAC resolved that each of the wild and enhanced components of the chum return be increased by 200,000 for the period 1987-1990. This would increase the threshold level of the Clockwork harvest strategy by 400,000 chum to 3,000,000 before commercial harvesting could commence. It should be noted that a U.S. origin chum component of 100,000 is also factored into the calculation of the stock size for the Clockwork plan. This component is invariable. Table 2 presents the basic components of the 1987-1990 Johnstone Strait Clockwork.

The DFO and SCAC agreed to review the potential for intermediate harvest rate steps (e.g., 35%), and the appropriateness of revising the wild and enhanced target levels in a mid-period review after the 1988 fishing season.

With regard to the jurisdiction of the Johnstone Strait Clockwork and its linkage with Fraser River management, the DFO and SCAC agreed to separate the Fraser River catches from the computation of Johnstone Strait allowable Clockwork catch, and to develop a separate Fraser River Clockwork strategy.

The protection and rebuilding of the northern Study Area chum stocks which apparently did not respond to the first four years of the Clockwork strategy, were also discussed. The two approaches recommended for rebuilding were fisheries regulation and stock enhancement. Advisors argued further regulation was not appropriate, considering the current degree of regulation and the magnitude of the problem. Instead, a strategy for a small scale enhancement program involving a limited number of systems was proposed and forwarded for review.

Table 2. Clockwork harvest rate schedule for chum stocks entering Johnstone Strait, 1987 - 1990.

Wild Stock (1)	Total Stock (2)	Harvest Rate
0 - 2.0 million	0 - 3.0 million	10%(3)
2.0 - 2.7	3.0 - 3.7	20%
2.7 - 4.2	3.7 - 5.2	30%
over 4.2	over 5.2	40%

(1) Wild stock includes populations with at least 25% of the return from wild spawning.

(2) Total stock = Wild + Enhanced + U.S. components. Pre-season, the theoretical annual expected enhanced component was set at 900,000 for the period 1987 to 1990, but could vary depending on SEP expectations. U.S. component was set at 100,000 for the period 1987 to 1990. In-season, the Clockwork allowable catch is based on the assessed total stock migrating through Johnstone Strait.

(3) The 10% harvest rate includes non-commercial catch, catch in the commercial assessment fisheries, and incidental catch in sockeye and pink fisheries. At a stock level below 3.0 million, commercial fisheries in Johnstone Strait will not be scheduled after the assessment fishery.

Fraser River Strategy

In 1987, the control of the commercial harvest of chum salmon in the Fraser River was accomplished through the Fraser River Chum Salmon Harvest Management Plan. This plan was part of the revisions to the South Coast Clockwork and was intended to ensure that the chum in the Fraser River would be managed to meet that system's spawning requirements. The Fraser River management plan, in order to function properly, required an estimate of the total chum return to the river, and the potential native and test fishery catches. Surpluses identified by subtracting from the total estimated return, the required escapement and the native and test catch components, would be made available to the Fraser River commercial fishery. In practice, the size of the Fraser chum return was estimated through the use of the Fraser River test fishery data. Appendix A outlines the objectives and strategy of the Fraser River management plan.

The gross escapement goal for the Fraser River chum is not a fixed target but a variable goal with a minimum requirement. This approach will potentially provide for larger escapements and a greater ability to determine the optimum Fraser River chum spawning target. Specifically, the spawning escapement goal would be increased by sharing between the spawning grounds and the commercial fishery those chum returns in excess of the basic spawning requirement of 700,000 chum. The sharing formula, developed in conjunction with the local fishing industry representatives (FRAC), allowed approximately 50% of the excess to be harvested and the balance to spawn.

Mid Vancouver Island Area Strategy

The terminal fishery in the Mid Vancouver Island area harvests primarily enhanced stocks returning to facilities on the Big Qualicum, Little Qualicum and Puntledge Rivers in Statistical Area 14. Note that in this report "Qualicum" refers to the fishery in Area 14 while "Mid Vancouver Island" refers to a geographical sub-group of stocks. Management of the Qualicum terminal fishery follows the guidelines provided by the SCAC in 1984, with minor modifications made subsequently by the Mid Vancouver Island Sub-committee. The Qualicum fishery, unlike the Johnstone Strait or Fraser River fisheries, is managed on the basis of conducting "early" fisheries prior to achieving specific and fixed escapement goals for the above enhanced systems. The major objective of this management strategy is to provide higher quality chum catch prior to deterioration of fish associated with spawning maturation. Other objectives include maximizing the harvest of surplus enhanced coho salmon, minimizing the harvest of chinook salmon, limiting Fraser River chum interceptions to less than 10% in all Qualicum fisheries, and achieving inside chum allocation between seine and gillnet gear. Appendix B outlines the Qualicum fishery objectives and management strategy.

Luedke et al. (1988) provide further details regarding the management of the Mid Vancouver Island stocks. In order to achieve a good quality catch, the Mid Vancouver Island management plan allocates a maximum of 75% of the expected

wild and enhanced surplus (i.e. the calculated Total Allowable Catch) to the MVI area to be harvested in "early" pre-escapement fisheries in 1987. After mid-November and once escapement needs have been met, further harvesting is generally limited to "clean-up" fisheries where lower quality catch is expected. In 1987, the MVI Sub-committee had altered the management plan to modestly increase the "early" harvest rate to 79% to ensure the expected late season clean-up catch would not exceed a maximum of 100,000 chum. An additional provision was the opportunity to harvest the Puntledge River stock prior to the late clean-up fisheries, by conducting a limited outside area fishery (sub-areas 14-9 and 14-10, Fig. 3). It was expected that these fisheries would marginally increase the catch of the Fraser River chum. However, pre-season expectations of Fraser stock strength indicated that surpluses were available and the 10% limitation on the interception of the Fraser River origin chum in the Qualicum fishery was removed.

Strategy for Other Terminal Areas

Annual variability in production among the Study Area stocks managed under the Clockwork strategy may result in harvestable terminal surpluses in certain areas. Terminal fisheries in these areas are managed to harvest the surpluses and achieve system-specific escapement goals.

DOMESTIC CATCH ALLOCATION

The Minister's Advisory Committee provides recommendations to the Minister of the Department of Fisheries and Oceans regarding allocation of catch among gear types. The South Coast inside chum allocation for 1987 was 65% for seines and 35% for gillnets. It was anticipated that the majority of the seine catch would occur in Johnstone Strait, while gillnet harvesting would be conducted primarily in the MVI and Cowichan River terminal areas.

PRE-SEASON EXPECTATIONS AND FISHING PLANS

The pre-season forecast of the total Study Area chum run is developed prior to each season as a general planning tool for conservation needs, catch and allocation requirements. The pre-season forecast of the total Study Area chum stock for 1987 was 3,125,000 and included 1,775,000 wild, 1,250,000 enhanced and 100,000 U.S. origin chum (Table 3). The enhanced component was expected to comprise 40.0% of the total estimated run, and was the largest expected enhanced return to date.

The wild run size was estimated by applying past average returns per spawner, adjusted for expected specific annual variations, and past average percent return by age group, to the appropriate brood year spawning abundance. The enhanced run size was estimated by applying the coastwide (SEP Biostandard) survival rate for each type of enhancement facility and the average return by age group, to the number of fry released by the facilities. Table 3 shows that the four dominant components of the total expected Study Area return were the wild

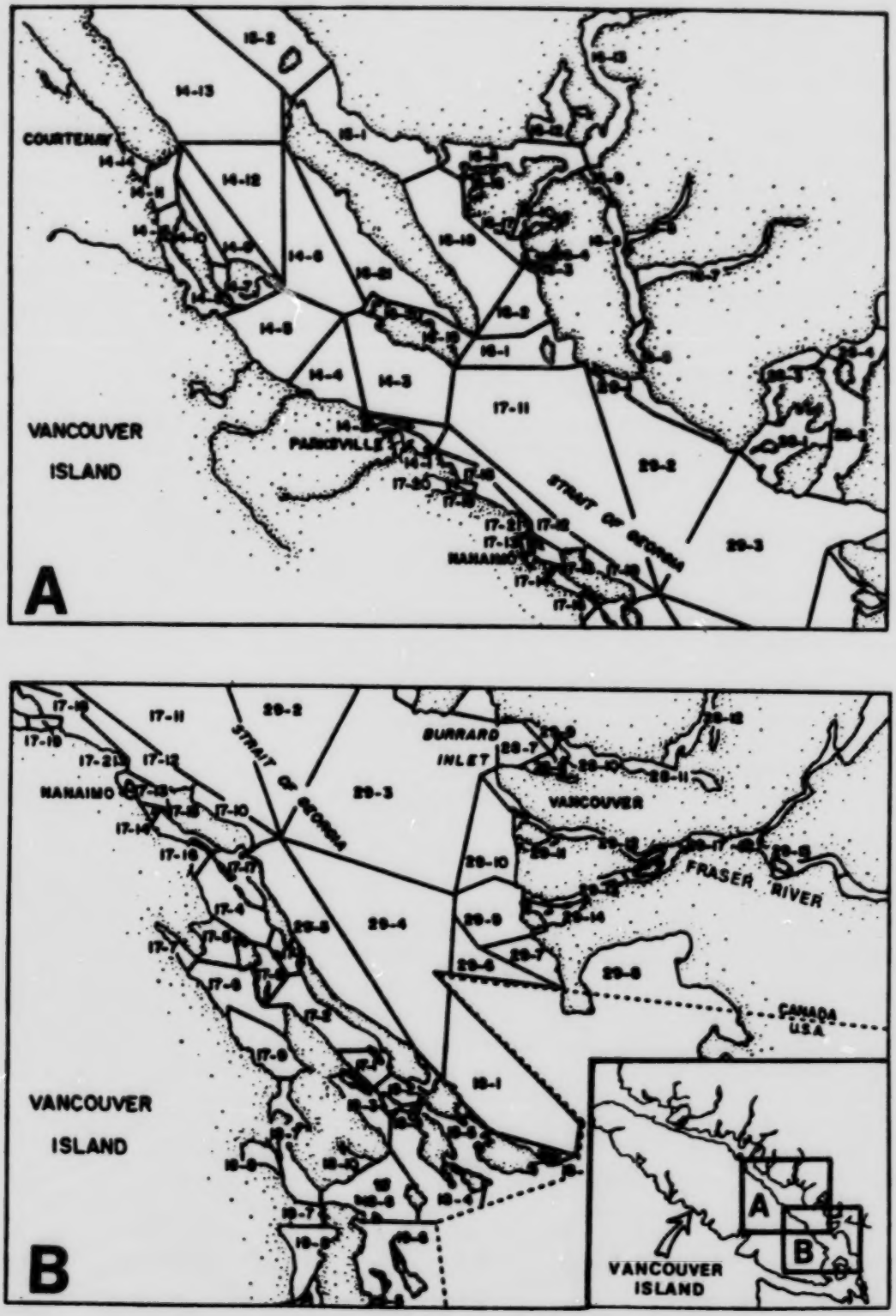

Fig. 3. Statistical sub-area map of Strait of Georgia (insert shows general location of sub-areas).

Table 3. Pre-season expectations (numbers and percent of overall total) of Study Area chum run size in 1987.

			Non-Fraser							
	Fraser River		MVI		Other		Total		Total	
Stock	No.	%	No.	%	No.	%	No.	%	No.	%
Wild	454,000	14.5%	204,000	6.5%	1,117,000	35.7%	1,321,000	-	1,775,000	56.8%
Enhanced	497,000 (1)	15.9%	669,000 (2)	21.4%	84,000 (3)	2.7%	753,000	-	1,250,000	40.0%
U.S.	-		-		-		-		100,000	3.2%
Total	951,000	30.4%	873,000	27.9%	1,201,000	38.4%	2,074,000		3,125,000	100.0%

(1) Fraser River enhanced chum include returns to the Chilliwack, Chehalis and Inch facilities.

(2) MVI enhanced chum include returns to the Big Qualicum, Little Qualicum and Puntledge facilities.

(3) Other enhanced chum include returns to miscellaneous facilities throughout the Study Area.

non-Fraser Study Area stocks (42%), the enhanced MVI stocks (21%), and the wild and enhanced Fraser River stocks, each at about 15% of the total. An additional 3% of the total run consisted of enhanced origin chum estimated to be returning to other areas, including the Howe Sound, Lower Vancouver Island and Jervis Inlet. Past data have shown that U.S. chum also migrate through Johnstone Strait, and for computational purposes, this component was set at 100,000 (Table 3).

Pre-season fishing plans are directly dependent on the expected abundance of returning stocks. Since the expected stock size (3.1 million) for 1987 fell in the 3.0 to 3.7 million range, a 20% harvest rate was anticipated under the Clockwork plan (Table 2). This harvest rate translated to a Total Allowable Catch (TAC) of 620,000 chum, not including any terminal harvests. Consequently, at least 2 one-day commercial chum fisheries were expected in Johnstone Strait in 1987; this is in addition to the assessment fishery which was to be conducted in Johnstone Strait in the third week of September.

In addition to the expected harvest of enhanced stocks in the Johnstone Strait fishery, terminal fisheries were anticipated on the MVI stocks in the Qualicum fishery. Terminal fisheries were scheduled to commence in early October for 2 to 3 days per week and continue until the target catch of 79% of the MVI TAC was met. Only minor catches of coho were expected from the limited surplus hatchery production. A terminal fishery on the Cowichan River stock in Area 18 was also anticipated for 1987.

While the pre-season estimates provide managers, user groups and industry an early indication of the fishing season, these estimates are often revised as the in-season estimates become available, and harvest plans become amended in accordance with the Clockwork strategy.

IN-SEASON STOCK ESTIMATES AND ACTUAL FISHERY CATCHES

COMMERCIAL AND TEST FISHERIES

In-season management decisions including the Clockwork harvest rate, are based on in-season estimates of the total chum run through Johnstone Strait. Assessments are made using commercial and test fishing data. The in-season stock estimates and the actual catches are presented below.

Johnstone Strait In-Season Stock Estimates

Commercial fishery: The first in-season update on chum abundance is determined each year in Johnstone Strait (Areas 12 and 13) from a commercial assessment fishery conducted during the third week of September. In 1987, the September assessment fishery was delayed one week in response to conservation requirements for late run Fraser River pink salmon. Consequently, the assessment fishery was held in the fourth week on September 21. Table 4 outlines in detail the in-season calculations and weekly and Clockwork estimates of the total Study

Table 4. In-season assessment of total Clockwork chum run through Johnstone Strait, 1987.

Stat Week	Indicator (1) Type	Area	Data Format	Regression Stats (2) Yrs	r2	X value	Weight	Results Point Estimate	Results Standard Error	Weekly Average Estimate (3)	Clockwork Stock Estimate (4)
9/4	Comm 9/3	12	Total Catch	14	0.73	36366	0	2,435,100	32%		
	Comm 9/3	12	Catch/seine	14	0.75	122	0	1,934,300	32%		
	Comm 9/3	12&13	Total Catch	14	0.68	54482	0	2,532,000	28%		
	Comm 9/3	12&13	Catch/seine	14	0.76	123	0	1,989,800	30%		
	Comm 9/3+4	12	Total Catch	14	0.56	36366	1	2,266,700	36%		
	Comm 9/3+4	12	Catch/seine	14	0.71	122	1	1,867,500	36%		
	Comm 9/3+4	12&13	Total Catch	14	0.46	54482	1	2,323,600	39%		
	Comm 9/3+4	12&13	Catch/seine	14	0.69	123	1	1,906,000	36%	2,091,000	2,091,000
10/1	Test	12	wk 9/4-10/1	7	0.93	258	0	1,610,000	17%		
	Test	12	wk 10/1	7	0.83	127	0	1,680,000	25%		
10/2	Test	12	wk 9/4-10/2	7	0.92	706	1	2,190,000	13%		
	Test	12	wk 10/1-10/2	7	0.90	575	1	2,420,000	13%	2,305,000	2,198,000
	Test	12	wk 10/2	7	0.69	448	0	3,120,000	18%		
10/3	Test	12	wk 9/4-10/3	7	0.96	959	1	2,190,000	9%		
	Test	12	wk 10/1-10/3	7	0.97	828	1	2,370,000	7%		
	Test	12	wk 10/2-10/3	7	0.94	702	1	2,880,000	9%	2,480,000	
	Test	12	wk 10/3	7	0.66	253	0	2,190,000	27%		
	Peak test	12	3 day Oct 10	7	0.72	306	1	2,190,500	25%		
	Peak test	12	5 day Oct 10	7	0.74	318	1	2,456,600	21%		
	Peak test	12	11 day Oct 10	7	0.82	351	1	2,848,800	15%	2,498,600	2,343,700
10/4	Test	12	wk 9/4-10/4	7	0.82	1111	1	2,074,100	21%		
	Test	12	wk 10/1-10/4	7	0.80	980	1	2,164,500	21%		
	Test	12	wk 10/2-10/4	7	0.71	867	1	2,363,900	23%		
	Test	12	wk 10/3-10/4	7	0.55	419	1	2,011,200	34%	2,153,400	2,305,600 (5)
	Test	12	wk 10/4	7	0.28	165	0	2,022,900	43%		

Seasonal average = 2,305,600

(1) Indicator types are Commercial fishery (Comm) and Test fishery (Test) in Areas 12 or 12 and 13 combined. Indicator is linear regression of Data Format with total Study Area chum stock. Test fishing results in the form of average weekly catch per set are used, as a single week (wk) or the SUM of several weekly averages.

(2) Yrs is the number of observations used in the regression. The r2 value indicates the strength of the regression. The x value predicts the total stock. The weight is the confidence DFO has placed in the regressions ability to predict the total stock: weight of 1 suggests complete confidence; weight of 0 suggests complete lack of confidence.
Note x value in 9/3 Comm is based on 1-day opening.
Note x values in Test are all based on average of both upper test vessels.

(3) The average weekly estimate is the average of weekly point estimates.

(4) Each Clockwork estimate is the average of all preceeding weekly average estimates.

(5) Seasonal average Clockwork estimate.

Area chum stock, based on commercial and test fishing data for Johnstone Strait. The data from the commercial assessment fishery in September indicated a total run through Johnstone Strait of about 2.1 million chum. This was below the pre-season expectation of 3.1 million and below the stock size of 3.0 million required by the Clockwork to initiate further commercial fisheries. Consequently, no further commercial fisheries were conducted in Johnstone Strait in 1987. Subsequent in-season run size updates were provided from test fishing data collected in the upper Johnstone Strait fishery (see section below).

Test fishery: In 1987, test fishing in upper Johnstone Strait (Area 12) commenced on September 4 and continued to November 12. Two seine vessels were contracted, with a third vessel contracted for two weeks in October to provide a more precise estimate around the peak of the run. Seine test fishery was also conducted in the lower Johnstone Strait (Area 13), fishing 3 days per week between September 16 and November 12, 1987. It should be noted that the past weekly test fishing data for the upper Johnstone Strait (Area 12) have been significantly correlated with total chum stock. The lower Johnstone Strait (Area 13) test fishing data have not been reliable in indicating stock size (Luedke et al. 1988).

Following the earlier commercial fishery estimate of 2.1 million chum, a second in-season update was made available October 10 (week 10/2) using the test fishing data. The update indicated a Clockwork stock size estimate of 2.2 million, corroborating the initial run size estimate (Table 4). Subsequent in-season run size updates were made on a weekly basis. It should be noted that the Clockwork management strategy requires weekly point estimates to be averaged to produce the estimated Clockwork run size update (Table 4).

For 1987, in addition to the weekly test assessments, a further assessment of the stock size was developed, correlating the test data from the peak migration period with stock size.

All subsequent in-season stock estimates remained below the 3.0 million level (Table 4). The final in-season Clockwork estimate for 1987 of the total chum return through Johnstone Strait was 2,305,600 chum (Table 4). Based on this estimate, the applicable Clockwork harvest rate was limited to 10% or less (Table 2), and no directed commercial fisheries were conducted in Johnstone Strait.

Johnstone Strait Fishery Catches

Commercial catches: The in-season catch estimates presented here have been revised and updated using sales slip information (BC Catch Statistics, 1988). The data are limited to fall chum catches, i.e. catches after September 1. Summer chum catches in the Study Area prior to September 1 totalled 37,200 (Table 5).

Table 5. Weekly commercial chum catch in the Study Area fisheries for all gear, 1987 (1).

Week Ending	Stat Week	Catch by Statistical Area 11-13	14	15-16	17	18-19	28-29	Total
to Aug. end		36,968	3	89	0	0	102	37,162
05-Sep	9/1	3,734	26	10	0	0	352	4,122
12-Sep	9/2	0	0	0	0	0	64	64
19-Sep	9/3	1	0	0	0	0	62	63
26-Sep	9/4	51,515 (2)	1	0	0	0	122	51,638
03-Oct	10/1	2	2	0	0	0	663	667
10-Oct	10/2	0	0	0	0	0	1,217	1,217
17-Oct	10/3	3,275	64,939	0	235	0	1,674	70,123
24-Oct	10/4	8,000	55,232	0	28	0	696	63,956
31-Oct	10/5	0	94,020	0	393	54	650	95,117
07-Nov	11/1	0	115,612	0	281	141	1,011	117,045
14-Nov	11/2	1,887	23,074	0	9,022	5,058	1,216	40,257
21-Nov	11/3	0	0	0	0	114	823	937
28-Nov	11/4	0	0	0	0	73	834	907
05-Dec	12/1	0	0	0	0	0	222	222
12-Dec	12/2	0	0	0	0	0	22	22
19-Dec	12/3	0	0	0	0	0	5	5
26-Dec	12/4	0	0	0	0	0	0	0
TOTAL		105,382	352,909	99	9,959	5,440	9,735	483,524
FALL CHUM TOTAL (3)		68,414	352,906	10	9,959	5,440	9,633	446,362 (4)
% BY AREA		15.3%	79.1%	0.0%	2.2%	1.2%	2.2%	

(1) Commercial catch is from BC Catch Statistics (1987) and includes test fishery payments.

(2) Only one directed (assessment) chum fishery (week 9/4) was held in Johnstone Strait in 1987.

(3) Catch from September 1 onward.

(4) This total excludes Area 20 fall chum catch of 20,487 fish, the majority (13,754) of which were harvested in a coho directed fishery during the week ending October 3. Note that the Canadian component (non-terminal) of the Area 20 catch is included in Table 13.

Table 5 shows the 1987 commercial chum catches in the Study Area by week and Statistical Area; Table 6 summarizes the catches by gear type and area. Weekly gear counts and days open are shown for each area in Appendix C and weekly management regulations are shown by area in Appendix D. The commercial assessment fishery conducted in the fourth week of September harvested 51,500 chum (Table 5). A fleet of 502 gillnets and 362 seines operated for 1.5 and 1.0 days, respectively (Appendices C and D). Additional early season catches and subsequent test fishery payment catches (see below) brought the total Johnstone Strait commercial catch of fall chum salmon to 68,400. Of this catch, 80% were taken by seines and the balance by gillnets (Table 6).

There was no directed Bute Inlet (Area 13) gillnet fishery in 1987. A review of past Bute Inlet fisheries, along with the area of fishing and catch data for the period 1970 to 1987, is provided in Appendix E.

Test fishing catches: Table 7 summarizes the weekly catch and effort data for the Johnstone Strait test fishery in Areas 12 and 13. Table 8 lists the set locations and the total sets and catches made per location in Area 12. During the early September to mid-November test fishing period, the contracted seine vessels enumerated in Johnstone Strait over 160,000 chum (Table 7), the large majority of which were released unharmed. A total of 13,100 chum of which 3,500 came from Area 13, were retained as payment for the test fishing operation (Table 5) and 2,500 for biological sampling.

Fraser River

In-season test fishing stock estimates: The 1987 Fraser River Clockwork plan required an estimate of the total number and timing of chum salmon returning to the terminal area. A preliminary estimate of total Fraser River chum run size was derived from the Johnstone Strait run size assessment and stock identification data. Subsequent estimates were based on terminal area test fishing, and were used for terminal area management.

Two gillnet test fisheries were conducted in the Fraser River; one in the lower fishing area near Ladner at Cottonwood, and one in the upper fishing area at Albion. Both fisheries began on October 1, 1987 and continued until late December of that year. The Cottonwood test fishery was used to estimate the chum return to the Fraser River and monitor the daily abundance, while the Albion test fishery was used to monitor chum abundance and the rate of their upstream movement.

The initial in-season estimate of the total Fraser River stock size, based on the Johnstone Strait data, totalled 636,000 chum (Table 9). This was 67% of the pre-season estimate of 951,000 chum (Table 3). Subsequent estimates based on the Johnstone Strait data indicated a Fraser River run size of about 700,000 chum. The initial Fraser River test fishery estimate of the terminal run size was made after two weeks of test fishing (October 15). This and subsequent estimates confirmed the earlier Johnstone Strait estimate and indicated the total

Table 6. Allocation of the commercial chum catch in the Study Area by gear, 1987(1).

	Areas 11-13		Area 14		Areas 15-19		Areas 28-29			
Gear	Catch	%	Catch	%	Catch	%	Catch	%	Total	%
Gillnet	13,822	20.2%	148,632	42.1%	15,400	99.9%	9,613	99.8%	187,467	42.0%
Seine	54,543	79 7%	203,785	57.7%	9	0.1%	0	0.0%	258,337	57.9%
Troll	49	0.1%	489	0.1%	0	0.0%	20	0.2%	558	0.1%
All	68,414		352,906		15,409		9,633		446,362	

(1) Commercial catch is from BC Catch Statistics (1987) and includes test fishery payments. Catches are from September 1 onward, except Area 29 which includes all catches.

Table 7. Weekly chum test fishery catch and effort in upper, mid and lower Johnstone Strait and in Juan de Fuca Strait, 1987(1).

Week ending	Week	UPPER JOHNSTONE STRAIT (Area 12) Weekly Catch	Sets (2)	CPUE (3)	MID JOHNSTONE STRAIT (Area 12) Weekly Catch	Sets	CPUE
05-Sep	9/1	39	12	3.3	20	12	1.7
12-Sep	9/2	64	24	2.7	362	42	8.6
19-Sep	9/3	1,818	18	101.0	870	36	24.2
26-Sep	9/4	3,650	17	214.7	1007	18	55.9
03-Oct	10/1	4,862	42	115.8	4072	36	113.1
10-Oct	10/2	20,453	30	681.8	11838	42	281.9
17-Oct	10/3	8,013	40	200.3	8687	26	334.1
24-Oct	10/4	2,898	30	96.6	8355	38	219.9
31-Oct	10/5	5,441	25	217.6	5355	21	255.0
07-Nov	11/1	5,604	30	186.8	2023	28	72.3
14-Nov	11/2	123	19	6.5	660	17	38.8
Total		52,965	287		43,249	316	

Week ending	Week	LOWER JOHNSTONE STRAIT (Area 13) Weekly Catch	Sets	CPUE	JUAN DE FUCA STRAIT (Area 20) Weekly Catch	Sets	CPUE
05-Sep	9/1	-	-	-	-	-	-
12-Sep	9/2	-	-	-	-	-	-
19-Sep	9/3	491	11	44.6	0	0	NA
26-Sep	9/4	1742	17	102.5	133	24	5.5 (4)
03-Oct	10/1	16947	16	1059.2	448	18	24.9
10-Oct	10/2	15566	18	864.8	701	22	31.9 (4)
17-Oct	10/3	3842	18	213.4	1381	18	76.7
24-Oct	10/4	8506	18	472.6	1258	18	69.9
31-Oct	10/5	7745	18	430.3	1715	16	107.2
07-Nov	11/1	10521	18	584.5	848	18	47.1
14-Nov	11/2	543	13	41.8	-	-	-
		65,903	147		6,484	134	

(1) Catch is determined from visual estimates by DFO observer and crew, or from actual counts if visual estimates differ; note that test fisheries were not conducted during commercial openings.

(2) Number of sets counted per statistical week.

(3) CPUE is average weekly catch per set.

(4) Includes set at Camper Bay in Juan de Fuca Strait.

Table 8. Johnstone Strait seine test fishery in Area 12, 1987(1).

SET LOCATION	LOC	# OF SETS	TOTAL CATCH	% OF SETS	% OF CATCH	AVG/ SET
BIG BAY	1	16	505	2.4%	0.5%	32
THE BLUFF	2	22	4562	3.2%	4.2%	207
BLOW HOLE	3	19	4169	2.8%	3.8%	219
BLUE LINE	4	11	6039	1.6%	5.5%	549
BOLD POINT	5	37	2068	5.5%	1.9%	56
CHINA TOWN	6	12	3035	1.8%	2.8%	253
CRACROFT	7	28	1256	4.1%	1.1%	45
DOUBLE BAY	8	37	8283	5.5%	7.6%	224
KELP POINT	9	42	2780	6.2%	2.5%	66
MERRY GO ROUND	10	12	325	1.8%	0.3%	27
PARSONS BAY	11	20	1299	2.9%	1.2%	65
SIWASH ROCK	12	20	2316	2.9%	2.1%	116
THE BANK	13	28	22790	4.1%	20.8%	814
WHITE ROCK	14	22	4056	3.2%	3.7%	184
WHITE BEACH	15	7	62	1.0%	0.1%	9
BLINKHORN	16	51	6173	7.5%	5.6%	121
RETURN POINT	17	13	727	1.9%	0.7%	56
FRESHWATER BAY	18	8	1584	1.2%	1.4%	198
IZUMI ROCK	19	45	5586	6.6%	5.1%	124
BAUZA COVE	20	0	0	0.0%	0.0%	0
FINE BEACH (RB)	21	57	11558	8.4%	10.5%	203
BEAVER COVE	22	0	0	0.0%	0.0%	0
NIMPKISH R.	23	0	0	0.0%	0.0%	0
BLACKFISH SOUND	24	5	521	0.7%	0.5%	104
MID-SUMMER ISL.	25	0	0	0.0%	0.0%	0
BROKEN ISLANDS	26	0	0	0.0%	0.0%	0
BEAUTIFUL BCH. (AR)	27	0	0	0.0%	0.0%	0
PIG RANCH	28	34	2055	5.0%	1.9%	60
GLORY HOLE	29	47	7482	6.9%	6.8%	159
HOT SPOT	30	46	8234	6.8%	7.5%	179
BOAT HARBOUR	31	0	0	0.0%	0.0%	0
HILLIER POINT	32	6	31	0.9%	0.0%	5
GROWLER COVE	33	0	0	0.0%	0.0%	0
SOFIA/SPLASH ISLAND	34	2	0	0.3%	0.0%	0
GRAVEL BEACH	35	7	292	1.0%	0.3%	42
NEEKIS BAY	36	6	37	0.9%	0.0%	6
GREEN SHACK	37	5	41	0.7%	0.0%	8
TOP OF HANSON	38	5	57	0.7%	0.1%	11
SPAWNING GROUND	39	4	892	0.6%	0.8%	223
FINE BEACH	40	4	864	0.6%	0.8%	216
NO LOCATION	99	0	0	0.0%	0.0%	0
TOTAL		678	109679	100.0%	100.0%	

(1) Sets represent combined upper and mid Johnstone Strait test fishing vessels.

Note: Data from the third vessel fishing only in October were included here but not in Table 7.

Table 9. Pre-season and weekly in-season estimates of Study Area chum stock size, 1987.

Month	Week	Total Stock(1)	TOTAL STOCK COMPONENTS: Fraser River	MVI Enhanced	Other Canadian	U.S.
PRE-SEASON (2)		3,125,000	951,000	669,000	1,405,000	100,000
IN-SEASON (3)						
Sep 26	9/4	2,090,900	636,300	447,600	907,000	100,000
Oct 10	10/2	2,198,000	668,900	470,500	958,600	100,000
Oct 17	10/3	2,343,600	732,600	501,700	1,028,700	100,000
Oct 24	10/4	2,305,600	701,600	493,600	1,010,400	100,000
Oct 31	10/5	-	642,000	-	-	-
Nov 14	11/2	-	632,000	-	-	-
Nov 28	11/4	-	622,000	-	-	-
Dec 19	12/3	-	622,000	-	-	-

(1) Total Stock is the sum of Stock Components (ie. enhanced and wild Study Area chum, and the U.S. origin chum).

(2) Pre-season estimates from Table 3.

(3) In-season estimate = In-season Clockwork Estimate from Table 4. Stock estimates to week 10/4 calculated from Johnstone Strait commercial and test fishery data. Estimates after week 10/4 for Fraser River stock only, from in-river test fishing. Note: the Fraser River estimate for week 10/3 is an average of both methods (ie. Johnstone Strait and Fraser River catch data).

run would not be large enough to support a commercial fishery in 1987. In addition, the predicted sizes of the early and late portions of the run into the river were below the overall spawning requirement of 700,000 chum. The final in-season estimate of the total Fraser River run size was 622,000 chum (Table 9).

Fishery catches: The Fraser River commercial net fishery for chum salmon was not opened in 1987. During the Fraser River Panel openings for sockeye and pink salmon in weeks 8/1 to 9/3, less than 600 chum were caught incidentally (Table 5), with the balance of the catches taken as payment by test fishing vessels. The total Fraser River chum catch that year was 9,700 of which 100 chum were caught in August (Table 5). The gillnet test fisheries conducted from October to December in the Fraser River, caught a total of 2,900 chum in the lower fishing area at Cottonwood, and 5,000 chum in the upper fishing area at Albion (Table 10).

Mid Vancouver Island

In-season stock estimates: The pre-season MVI stock estimate was expected to total 204,000 wild and 669,000 enhanced chum for an overall return of 873,000 chum (Table 3). The above enhanced component included the expected returns to the Big Qualicum, Little Qualicum and Puntledge systems. In-season, the estimation of returning wild and enhanced MVI chum is computed as a portion of the estimated total run size assessed through Johnstone Strait (Luedke et al. 1988). The in-season stock estimates made in Johnstone Strait through the fourth week of October (Table 9), lowered the MVI stock to an expected total return of 773,000 chum. The Qualicum fisheries were refined in response to the revised run size in conjunction with the MVI advisory group and the MAC allocation formula.

Qualicum fishery catches: The Qualicum fishery in Area 14 opened in the third week of October for gillnets only. This opening was one week later than the previous year due to conservation concerns for local wild coho and chinook stocks. Fisheries occurred in each of the four subsequent weeks, generally alternating between gillnet and seine gear. Gillnets operated for a total of 4.0 days and seines for 4.3 days (Appendices C and D). The upper fishing area consisted of portions of sub-areas 14-9, 10, 11; the lower fishing area consisted of sub-areas 14-4, 5, 7 (Fig. 3), with the beach boundary varying between 1.0 and 1.5 miles off the beach and the outside boundary located 5 miles off the beach.

Table 5 shows the weekly chum catches in Area 14. The total reported catch was approximately 353,000 chum, of which 58% were taken by seines and 42% by gillnets (Table 6). Due to an overestimate of the total MVI stock size, the clean-up fishery expected in late November to harvest surplus chum was not required.

Nanaimo and Cowichan Terminal Fisheries

The surplus chum identified in the Nanaimo (Area 17) and Cowichan (Area 18) regions were harvested in gillnet only terminal fisheries held for one day on

Table 10. Annual Fraser River chum test fishery catch and catch per unit effort, 1963-1987.

Year	Cottonwood Catch	Cottonwood CPUE	Albion Catch	Albion CPUE	Total Catch
1963	1,843	166.4	N/A	N/A	1,843
1964	N/A	N/A	N/A	N/A	0
1965	1,154	108.2	N/A	N/A	1,154
1966	3,271	305.4	N/A	N/A	3,271
1967	1,630	152.6	N/A	N/A	1,630
1968	4,156	372.9	N/A	N/A	4,156
1969	2,132	221.0	N/A	N/A	2,132
1970	5,101	463.0	N/A	N/A	5,101
1971	3,431	313.2	N/A	N/A	3,431
1972	3,049	358.1	N/A	N/A	3,049
1973	2,980	292.7	N/A	N/A	2,980
1974	3,296	309.0	N/A	N/A	3,296
1975	1,823	151.7	N/A	N/A	1,823
1976	3,200	339.7	N/A	N/A	3,200
1977	5,046	488.5	N/A	N/A	5,046
1978	6,063	518.9	N/A	N/A	6,063
1979	3,240	257.1	2,886	248.1	6,126
1980	4,286	303.6	3,988	303.4	8,274
1981	3,008	224.9	3,929	321.5	6,937
1982	2,678	217.7	5,519	392.3	8,197
1983	2,558	250.6	4,644	369.6	7,202
1984	6,317	503.9	6,690	504.2	13,007
1985	4,836	431.5	7,596	586.3	12,432
1986	5,528	494.2	5,635	558.2	11,163
1987	2,945	280.3	5,038	511.5	7,983
Average					
1963-69	2,364	221.1	N/A	N/A	2,364
1970-79	3,723	349.2	N/A	N/A	4,012
1980-89	4,020	338.3	5,380	443.4	9,399

November 9, coincident with the Qualicum fishery opening. The fleet operated in sub-areas 17-12, 13 to harvest the Nanaimo River chum, and in Satellite Channel sub-area 18-6 (Fig. 3) to harvest the Cowichan River chum. The total terminal catch was approximately 10,000 chum in Area 17 and 5,400 chum in Area 18 (Table 5).

Other Fisheries

Other commercial fisheries which harvest at least some component of the Study Area chum salmon include the test fishery and the coho directed fishery in the Juan de Fuca Strait (Area 20), the Nitinat net fishery in Area 21 and the west coast of Vancouver Island (WCVI) troll fisheries. The seine test fishery in Area 20 extended from September 22 through November 5, 1987, fishing 3 days per week. The coho directed fishery in that area occurred the week ending October 3, 1987. A total of 20,500 fall chum were harvested, with the majority (13,800) taken in the coho directed fishery (Table 24d). The seine test fishery retained 6,300 chum for payment. The Nitinat catch of Study Area stock, as estimated by GSI, was 69,800 out of a total calculated harvest for that area of approximately 395,000 chum (Table 24e). Included in this total were 12,400 Fraser River origin chum. The sampling program for the 1987 WCVI troll fishery was not representative of the total WCVI troll catch and the total catch was not divided by its components.

INDIAN FOOD FISHERIES

The Indian food fisheries (IFF) for chum salmon are not restricted by the Clockwork harvest management strategy. However, these catches are included in calculations of the overall Clockwork catch and harvest rate. Table 11 summarizes the annual IFF catches by Statistical Area for the period 1960 to 1987. The overall IFF catch for 1987 was approximately 84,000 chum, the largest on record. This included the Fraser River catch component of about 26,000 chum, also the largest on record.

AMERICAN FISHERIES

The total catch of chum salmon in the United States waters of Juan de Fuca Strait (Areas 4B, 5, 6C), San Juan Islands (Area 7) and Point Roberts (Area 7A) is limited by the International Treaty. As previously reported (Hop Wo et al. 1987), the Canadian component is only a portion of the catch in these areas and is calculated by applying a fixed percentage of 40% to the Juan de Fuca Strait catch, 70% to the San Juan Islands catch and 95% to the Point Roberts catch.

Table 12 summarizes the total chum catches in the U.S. fisheries and the estimated Canadian component of these catches for the period 1960-1987. Past estimates of the Canadian catch component in the U.S. Juan de Fuca area have been revised in some years and the table updated. In 1987, the Canadian component in the U.S. fisheries totalled 38,800 chum. The fishery in the U.S. Juan de Fuca area (4B, 5, 6C) has expanded substantially since the early 1980s and for the

Table 11. Indian food fishery catch of chum salmon by Statistical Area, 1960-1987.

	Statistical Area (1)													
Year	12	13	14	15	16	17	18	19	28+29(2)	Fraser River(3)	Total J.St.(4)	Total G.St.(5)	Total JSt/GS	Grand Total
1960	4,600	2,583	245	3,500	4,500	750	2,231	625	2,200	9,970	7,183	14,051	21,234	31,204
1961	4,600	2,431	150	2,500	300	700	1,978	769	5,000	9,647	7,031	11,397	18,428	28,075
1962	4,391	1,412	45	2,000	400	860	3,197	415	2,800	11,300	5,803	9,717	15,520	26,820
1963	5,122	1,359	506	1,500	650	280	3,317		2,300	10,741	6,481	8,553	15,034	25,775
1964	6,054	1,756	21	1,200	400	580	1,773		2,000	12,210	7,810	5,974	13,784	25,994
1965	3,432	748	124	500	100	400	1,960		1,302	7,390	4,180	4,386	8,566	15,956
1966	4,314		157	950	400	1,480	2,772		1,050	12,181	4,314	6,809	11,123	23,304
1967	5,201		215	200	600	850	4,000		3,136	8,800	5,201	9,001	14,202	23,002
1968	4,046	1,708	360	2,356	349	905	5,395	340	3,500	11,102	5,754	13,205	18,959	30,061
1969	3,367	3,346	440	2,162	300	1,745	3,400	754	2,265	4,300	6,713	11,066	17,779	22,079
1970	3,632	4,725	972	1,652	200	3,000	2,204	170	5,650	5,603	8,357	13,848	22,205	27,808
1971	4,406	3,677	850	1,952	1,317	2,275	1,375	175	4,650	4,022	8,083	12,594	20,677	24,699
1972	5,487	4,690	265	1,320	243	4,675	3,000	300	2,112	6,301	10,177	11,915	22,092	28,393
1973	2,979	3,543	5,530	1,400	637	4,800	2,200	1,250	900	10,742	6,522	16,717	23,239	33,981
1974	4,814	6,940	14,000	2,000	300	6,000	5,000	800	2,250	15,102	11,754	30,350	42,104	57,206
1975	6,800	5,656	2,800	3,000	400	1,700	2,200	795	2,000	7,087	12,456	12,895	25,351	32,438
1976	3,400	6,679	9,273	2,200	55	1,800	3,500	450	7,400	13,603	10,079	24,678	34,757	48,360
1977	8,030	9,419		5,000	2,036	2,550	3,350	285	2,178	9,342	17,449	15,399	32,848	42,190
1978	3,750	5,572			1,263	4,805	3,000	1,000	5,545	9,509	9,322	15,613	24,935	34,444
1979	6,900	7,836	950		1,639	4,470	1,500	950	2,424	8,202	14,736	11,933	26,669	34,871
1980		12,155	4,576	3,000	1,500	2,750	1,000	1,055	4,952	12,333	12,155	18,833	30,988	43,321
1981	4,700	6,779	13,044	5,500	1,500	2,200	2,000	1,000	4,440	11,170	11,479	29,684	41,163	52,333
1982	8,456	12,733	1,212	6,000	664	3,588	2,000	6,200	4,281	19,233	21,189	23,945	45,134	64,367
1983	7,608	77	3,154	4,200	1,180	9,550	5,000	4,100	2,124	12,637	7,685	29,308	36,993	49,630
1984	11,906	9,000	2,000	3,000		8,000	4,000	4,500	3,287	18,635	20,906	24,787	45,693	64,328
1985	3,692	9,070	36,576	5,500	0	5,800	0	8,400	1,158	5,859	12,762	57,434	70,196	76,055
1986	4,615	7,540	1,161	2,907	1,800	4,950	9,338	7,000	3,219	16,711	12,155	30,375	42,530	59,241
1987	7,109	15,150	95	4,000	0	7,450	10,127	9,575	3,921	26,312	22,259	35,168	57,427	83,739
Ave.														
60-69	4,513	1,918	226	1,687	800	855	3,002	581	2,555	9,764	6,047	9,416	15,463	25,227
70-79	5,020	5,874	4,330	2,316	809	3,608	2,733	618	3,511	9,624	10,894	16,594	27,488	36,439
80-87	6,869	9,063	7,727	4,263	949	5,536	4,183	5,229	3,423	15,361	15,074	31,192	46,266	61,627
60-87	5,312	5,638	3,797	2,673	842	3,175	3,243	2,213	3,144	11,073	10,357	18,201	28,558	39,631

(1) Sources: Bijsterveld and James (1986) and Annual Pacific Region Indian Food Fishery Catch Statistics (1985-1987).

(2) All Area 29 streams excluding the Fraser River.

(3) Fraser River data from MacDonald (1987); Fraser River IFF catch for 1986 does not include 40,287 Harrison River experimental surplus.

(4) Johnstone Strait (Areas 12 and 13).

(5) Strait of Georgia (Areas 14 - 19, 28 and 29 excluding the Fraser River).

Table 12. U.S. fisheries chum catch in Juan de Fuca Strait (Areas 4B,5,6C), San Juan Islands (Area 7) and Point Roberts (Area 7A), and estimated Canadian stock component, 1960 - 1987.

	U.S. Fisheries(1)				Canadian Stock Component(2)				Total Clockwork Assessed US catch of Canada chum(3)
YEAR	(4B, 5, 6C)	7	7A	Total	(4B, 5, 6C)	7	7A	Total	
1960	578	6,712	19,683	26,973	231	4,698	18,699	23,628	23,397
1961	63	10,164	11,203	21,430	25	7,115	10,643	17,783	17,758
1962	102	6,695	5,531	12,328	41	4,687	5,254	9,982	9,941
1963	1,126	5,798	7,269	14,193	450	4,059	6,906	11,415	10,964
1964	1,366	6,304	8,665	16,335	546	4,413	8,232	13,191	12,645
1965	634	4,897	3,161	8,692	254	3,428	3,003	6,684	6,431
1966	676	3,484	9,010	13,170	270	2,439	8,560	11,269	10,998
1967	2,150	2,868	8,421	13,439	860	2,008	8,000	10,868	10,008
1968	2,698	21,980	72,197	96,875	1,079	15,386	68,587	85,052	83,973
1969	2,297	16,769	32,837	51,903	919	11,738	31,195	43,852	42,933
1970	1,039	20,340	55,118	76,497	416	14,238	52,362	67,016	66,600
1971	604	13,050	13,895	27,549	242	9,135	13,200	22,577	22,335
1972	1,874	163,584	177,768	343,226	750	114,509	168,880	284,138	283,388
1973	2,009	135,740	138,205	275,954	804	95,018	131,295	227,116	226,313
1974	3,998	105,420	95,707	205,125	1,599	73,794	90,922	166,315	164,716
1975	819	41,963	50,757	93,539	328	29,374	48,219	77,921	77,593
1976	3,519	171,331	105,885	280,735	1,408	119,932	100,591	221,930	220,522
1977	1,956	32,040	23,162	57,158	782	22,428	22,004	45,214	44,432
1978	867	261,653	165,327	427,847	347	183,157	157,061	340,565	340,218
1979	1,258	2,982	1,978	6,218	503	2,087	1,879	4,470	3,967
1980	11,455	206,776	143,185	361,416	4,582	144,743	136,026	285,351	280,769
1981	2,409	7,163	1,997	11,569	964	5,014	1,897	7,875	6,911
1982	5,154	41,385	34,786	81,325	2,062	28,970	33,047	64,078	62,018
1983	15,308	2,361	386	18,055	6,123	1,653	367	8,143	2,019
1984	15,144	846	796	16,786	6,058	592	756	7,406	1,348
1985	48,279	71,665	93,105	213,049	19,312	50,166	88,450	157,927	138,615
1986	53,790	45,696	47,228	146,714	21,516	31,987	44,867	98,370	76,854
1987	44,002	14,411	11,722	70,135	17,601	10,088	11,136	38,824	21,224
AVERAGES :									
60-69	1,169	8,567	17,798	27,534	468	5,997	16,908	23,372	22,905
70-79	1,794	94,810	82,780	179,385	718	66,367	78,641	145,726	145,008
80-87	24,443	48,788	41,651	114,881	9,777	34,152	39,568	83,497	73,720
60-87	8,042	50,860	47,821	106,723	3,217	35,602	45,430	84,249	81,032

(1) U.S. catch data from PSC Joint Chum Technical reports.

(2) Canadian catch component in Areas 4B, 5, and 6C is 40% of total catch.
Canadian catch component in Area 7 is 70% of total catch.
Canadian catch component in Area 7A is 95% of total catch.
Note that the Fraser River component of Canadian component is 80% in Areas 4B, 5, 6C and 7; and 95% in Area 7A.

(3) Total Clockwork assessed U.S. catch of Canadian chum is limited to U.S. Areas 7 and 7A (ie. excludes Juan de Fuca Canadian catch components in Areas 4B, 5, 6C).

first time has dominated the combined U.S. catch. In 1987, the Juan de Fuca catch contributed 63% to the total U.S. catch (Table 12), primarily the result of limited harvesting in U.S. Areas 7 and 7A.

The Canadian component in U.S. fisheries was lower in 1987 than in previous two years. This was attributed to low chum abundance estimates for Johnstone Strait and the International Treaty requirements for U.S. chum catch limitations in U.S. Areas 7 and 7A during years of low Canadian chum abundance.

POST-SEASON ANALYSIS AND EVALUATION

FISHERY REVIEW

The estimated in-season run size of 2.3 million chum returning through Johnstone Strait in 1987 was lower than the pre-season expectation of 3.1 million. This limited the Clockwork harvest rate to a maximum of 10% or less, and restricted commercial harvesting in Johnstone Strait to a single assessment fishery conducted in late September. Surplus stock was identified and harvested in terminal fisheries, with five openings held in the MVI area, and one opening in each of the Nanaimo and Cowichan areas. Fisheries in Areas 20 and 21 also harvested a component of the Study Area chum salmon.

Table 13 shows the breakdown of the total Study Area chum catch by its components for the period 1960 to 1987. In 1987, the catches were as follows:

Catch Component	No. Chum
Commercial Fishery and Test Fishery Payments	446,400*
IFF	83,700
Area 20	14,800
Area 21	69,800
U.S. Areas 4B, 5, 6C, 7, 7A	38,800
Non-reported and Hatchery Rack Sales	25,400
Total	678,900**
Total less the U.S. origin chum catch of 13,400	665,000+

* Catches in the Study Area.
** Includes the U.S. origin chum in Canadian catches.
\+ Value rounded off.

As seen above, the total catch of the Study Area chum in 1987 was 665,000. The Canadian commercial chum catch in the Study Area of 446,000 was dominated by the Qualicum fishery in Area 14 (79% of the total) and the Johnstone Strait fishery in Areas 11-13 (15%); the remaining 6% of the commercial catch came from the Nanaimo, Cowichan and Fraser River areas (Table 5). The relatively low Johnstone Strait catch reflected the Clockwork requirement of a 10% harvest rate, and consequently, the increased catch in terminal fisheries.

Table 13. Study Area chum catch, escapement and total stock, 1960 - 1987.

Year	CHUM CATCH: Commercial Catch (1)	Hatchery Rack Sales Non-IFF (2)	Non-reported Catch (3)	Area 20 Study Origin (4)	Area 21 Study Origin (5)	US Component In Canadian Catch (6)	IFF (7)	U.S. Waters: USA 4B,5,6C (8)	Clockwork USA 7,7A (9)	Total Clockwork Catch (10)	Total Study Area Catch (11)	Total Escapement (12)	Total Clockwork Assessed Stock (13)	Total Study Area Stock (14)
1960	737,390			9,279	0	27,258	31,204	231	23,397	791,991	774,243	742,220	1,534,211	1,516,463
61	334,871			294,496	0	10,516	28,075	25	17,758	380,704	664,709	646,725	1,027,429	1,311,434
62	250,036			11,261	0	5,987	26,820	41	9,941	286,797	292,112	713,677	1,000,474	1,005,789
63	318,551			13,264	0	11,291	25,775	450	10,964	355,290	357,714	689,725	1,045,015	1,047,439
64	144,712			20,164	0	3,634	25,994	546	12,645	183,351	200,427	899,500	1,082,851	1,099,927
65	26,360			27,432	0	640	15,956	254	6,431	48,747	75,792	401,350	450,097	477,142
66	44,046			16,796	0	1,332	23,304	270	10,998	78,348	94,083	994,005	1,072,353	1,088,088
67	165,220			12,690	0	5,336	23,002	860	10,008	198,230	206,444	709,305	907,535	915,749
68	780,275			19,635	0	25,473	30,061	1,079	83,973	894,309	889,551	1,886,523	2,780,832	2,776,074
69	594,821			12,564	0	21,202	22,079	919	42,933	659,833	652,115	1,087,255	1,747,088	1,739,370
70	971,980			17,831	0	31,731	27,808	416	66,600	1,066,388	1,052,904	1,161,656	2,228,044	2,214,560
71	111,850			14,112	0	4,001	24,699	242	22,335	158,884	169,237	678,224	837,108	847,461
72	1,925,500			107,299	0	68,036	28,393	750	283,388	2,237,281	2,277,294	1,833,854	4,071,135	4,111,148
73	2,896,579	800		109,230	0	113,248	33,981	804	226,313	3,157,673	3,154,458	1,572,130	4,729,803	4,726,588
74	359,988	0		49,415	0	11,354	57,206	1,599	164,716	581,910	621,570	1,222,296	1,804,206	1,843,866
75	481,659	0		28,645	0	18,385	32,438	328	77,593	591,690	602,277	667,446	1,259,136	1,269,723
76	948,039	63		76,730	0	35,188	48,360	1,408	220,522	1,216,984	1,259,934	947,364	2,164,348	2,207,298
77	131,833	0		13,777	0	5,306	42,190	782	44,432	218,455	227,708	1,440,712	1,659,167	1,668,420
78	1,381,669	3966		28,047	0	57,435	34,444	347	340,218	1,760,297	1,731,256	1,410,732	3,171,029	3,141,988
79	65,163	450		2,233	0	2,648	34,871	503	3,967	104,451	104,539	758,314	862,765	862,853
80	797,107	4630		34,170	35	33,185	43,321	4,582	280,769	1,125,827	1,131,429	1,325,098	2,450,925	2,456,527
81	120,948	5090	15,835	4,508	124	4,675	52,333	964	6,911	201,117	202,038	1,291,138	1,492,255	1,493,176
82	1,413,355	1112	35,589	11,633	135	78,049	64,367	2,062	62,016	1,576,439	1,512,220	1,480,047	3,056,486	2,992,267
83	233,299	20804	72,421	34	92	26,135	49,630	6,123	2,019	378,173	358,287	1,232,868	1,611,041	1,591,155
84	204,361	1542	51,341	1	37,765	12,636	64,328	6,058	1,348	322,920	354,108	1,595,151	1,918,071	1,949,259
85	1,095,011	30704	29,950	3,512	398,951	61,743	76,055	19,312	138,615	1,370,335	1,730,368	2,698,181	4,068,516	4,428,549
86	1,473,643	42257	39,214	2,539	89,123	24,157	59,241	21,516	76,854	1,691,209	1,780,231	2,097,749	3,788,958	3,877,980
87	446,362	83	25,317	14,841	69,758	13,439	83,739	17,601	21,224	576,725	665,485	1,406,211	1,982,936	2,071,696
Average														
1960-69	339,628			43,758		11,267	25,227	468	22,905	387,760	420,719	877,029	1,264,788	1,297,747
1970-79	927,426	754		44,732		34,733	36,439	718	145,008	1,109,401	1,120,118	1,169,273	2,278,674	2,289,390
1980-87	723,011	13,278	38,524	8,905	74,498	31,752	61,627	9,777	73,720	905,343	966,771	1,640,805	2,546,149	2,607,576
1960-87	659,094	7,433	38,524	34,148	21,285	25,501	39,631	3,217	81,032	793,370	826,519	1,199,623	1,992,993	2,026,142

Table 13 (cont'd)

(1) Commercial catches are from BC Catch Statistics. They include mixed and terminal catches, and test fishery payments (see footnote 3). The catch data include gillnet, seine and troll catches from Areas 11-19 and 28-29. Catch are from September 1 onward, except Area 29 which includes all catches.

(2) Chum sales of hatchery surpluses not included in commercial catch or escapement (Note: these are non-IFF sales).

(3) Non-reported catches are from Areas 14, 17 and 18 and are the difference between the in-season catch estimates and the sales slip totals in those years when the field estimates exceeded the reported sales slip estimates (see Table 20). These catches also include fall chum from test fish payment catches and GSI samples from Areas 14-19 and 29. Test and GSI samples from Areas 11-13, 20 and 21 are included in commercial catches.

(4) Study Area chum, as determined from GSI sampling, caught in Area 20 after Sep 1, 1985-1987. Prior to 1985, used a composite curve.

(5) Study Area chum, as determined from GSI sampling, caught in Area 21 after Sep 1, 1984-87. Prior to 1984, Area 21 catch occurred in Nitinat Lake (ie. no interception of Fraser or JS/GS origin chum).

(6) U.S. catch component in Areas 11-13 and 14 as estimated by:
1982-87: applied stock composition from Area 12 and 14 GSI data to Areas 11-13 and Area 14 catch by week
1960-81: applied average stock composition results from 1982-89 to annual catch for Areas 11-13 and Area 14.

(7) Indian food fisheries from throughout the Study Area (ie. Areas 11-19 and 28-29); see Table 11.

(8) Canadian component of U.S. catch in Areas 4B, 5, 6C (Juan de Fuca Strait); see Table 12.

(9) Canadian component of U.S. catch in Area 7 (San Juan Islands) and Area 7A (Point Roberts); see Table 12.

(10) Catch to be assessed by Clockwork management strategy. This catch includes Commercial, Hatchery Rack sales, Non-reported, IFF and U.S. Areas 7 and 7A Canadian component; ie. columns (1)+(2)+(3)+(7)+(9).

(11) Total Study Area Catch includes Total Clockwork Catch plus the catch in Areas 20-21 plus U.S. Areas 4B, 5, 6C Canadian component minus U.S. component in Canadian catch, ie. columns (10)+(4)+(5)+(8)-(6).

(12) Escapements from BC 16's; exclude the summer runs of Orford and Ahnuhati Rivers; include escapements to SEP channels and hatchery broodstock egg take requirements.

(13) Total Clockwork Assessed Stock includes Total Clockwork Catch plus Escapement, ie. columns (10)+(12).

(14) Total Study Area Stock includes Total Study Area Catch plus Escapement, ie. columns (11)+(12). Note that the total Study Area Stock excludes U.S. component in Canadian catch.

ESCAPEMENT SUMMARY

The wild and enhanced escapements of the Study Area chum salmon are summarized by major stock/system for the period 1970 to 1987 in Table 14. Appendix F lists the escapements to individual rivers. The escapement format has been upgraded for 1987 to provide separate wild and enhanced components; the past data have been revised accordingly. Enhanced escapements include chum salmon returning to spawning channels (e.g. Big Qualicum River) and chum harvested specifically for egg takes (e.g. Puntledge).

The total escapement of Study Area chum in 1987 was estimated to be 1,406,000 of which 1,235,000 (88%) were wild and 172,000 (12%) were enhanced spawners. The distribution of escapement was skewed to the southern Study Area, especially the Fraser River which contributed approximately 34% to the total Study Area escapement. The Fraser River wild component of 431,000 was well below the escapement target of 700,000. The Howe Sound/Sunshine Coast escapement, estimated at 69,100, was the lowest recorded in over 10 years. Similarly, the wild escapements to the northern areas, notably the Johnstone Strait, Loughbrough/Bute and Upper Vancouver Island, decreased or remained low. The Mid Vancouver Island stocks also showed a marked decline in wild escapements. Only the South Vancouver Island stocks estimated at 256,000, exceeded the target level (Table 14).

The enhanced components were as follows:

Stock/System	1987 Enhanced Chum Escapement*
Fraser River	44,900
MVI - Big Qualicum R. Channel	72,800
- Little Qualicum R. Channel	50,200
- Puntledge Hatchery	3,700
MVI Total	126,700
Total	171,600

* From Table 14 and Appendix F.

Of the three MVI facilities, only the Big Qualicum River Channel did not achieve its escapement target of 90,000 chum for 1987.

The Study Area chum escapement is indicative of the status of these stocks and is one measure of the success of the Clockwork management strategy. Luedke et al. (1988) documented the historical trends in annual escapements to the total Study Area for the period 1949 to 1986. In that period, annual escapements fluctuated greatly and were generally below the 1.4 million level (Appendix F). The concept for the development of the Clockwork management strategy was to rebuild wild escapements by limiting harvest rates. It was recognized that in some years, even though minimal harvest rates are applied, escapement levels may not achieve interim goals. The optimum escapement of wild Study Area chum is currently estimated to be 2.5 million (Table 14), with the interim goal of 2.0 million set for 1987. This interim escapement target was not achieved in 1987,

Table 14. Escapements of Study Area chum salmon, in thousands, 1970-1987.

Stock/System	Target	1987	1986	1985	1984	1983	1982	1981	1980	70-79
WILD STOCKS										
Upper Vanc Is	33.0	0.6	0.9	0.9	0.4	0.3	0.0	0.0	0.0	1.4
Kingcome	114.0	5.1	2.3	5.7	6.0	7.9	14.5	11.6	14.1	39.9
Bond/Knight(1)	220.0	33.0	25.2	43.0	50.3	32.6	70.0	9.8	34.6	68.1
Johnstone St	137.0	16.9	98.1	78.4	46.1	9.5	59.9	16.6	17.8	18.5
Lough/Bute(1)	150.0	95.6	295.4	117.3	124.8	102.2	237.3	150.5	163.4	97.3
Mid Vanc Is	149.0	99.6	149.0	196.5	123.8	155.7	151.8	144.2	111.3	116.8
Toba Inlet	136.0	10.3	4.4	11.4	19.6	17.7	12.5	16.5	6.3	16.5
Jervis Inlet	150.0	110.6	91.6	165.6	122.4	73.6	50.3	92.7	105.4	72.3
South Vanc Is	147.0	256.3	129.3	256.0	139.0	115.5	172.6	130.7	156.5	90.5
Lower Vanc Is	238.0	68.1	33.4	95.6	89.7	72.9	85.9	52.0	63.1	53.8
Howe/Sunshine	350.0	69.1	220.5	369.6	155.8	86.5	133.8	130.1	231.5	129.3
Burrard Inlet	50.0	38.4	32.7	30.6	31.0	27.1	24.4	18.9	15.5	17.1
Fraser River	700.0	431.0	802.0	1122.2	533.0	365.0	320.3	435.3	312.1	339.1
Boundary Bay	5.0	0.2	0.3	0.3	0.8	0.4	0.2	0.1	0.2	0.2
Study Area Wild Total	2579.0	1234.6	1885.1	2493.2	1442.7	1066.7	1333.3	1209.1	1231.9	1060.7
ENHANCED STOCKS										
Mid Vanc Is	150.0	126.7	181.1	179.5	145.2	163.8	144.7	82.0	93.2	113.3
Fraser River	30.0	44.9	31.6	25.5	7.3	2.4	2.0	0.0	0.1	0.0
Enhanced Total	180.0	171.6	212.7	205.0	152.4	166.2	146.7	82.0	93.2	113.3
Study Area Grand	2759.0	1406.2	2097.7	2698.2	1595.2	1232.9	1480.0	1291.1	1325.1	1174.0

(1) Summer run stocks (Ahnuhati in Knight Inlet and Orford in Bute Inlet) not included.

and the wild escapement of 1.2 million chum represented only 59% of the interim target. In addition, the total Study Area chum escapement that year was only 1.4 million, the lowest since the inception of the Clockwork program in 1983 (Table 14). This apparent lack of spawning success in 1987 must be evaluated in light of the low total stock production that year.

TOTAL STUDY AREA STOCK

The total Study Area stock is the sum of the total Study Area catch and total escapement (wild and enhanced) (Table 13). The total Study Area catch consists of the total Clockwork catch (i.e. commercial catch, test fishery payments, hatchery rack sales, non-reported catch, Indian food fishery catch and Canadian catch component in the U.S. Areas 7 and 7A, plus the catch of Study Area chum in outside regions (Areas 20 and 21, and U.S. Areas 4B, 5 and 6C), less the U.S. origin component in the Study Area catch (see Tables 1 and 13 for details).

Table 13 shows the breakdown of the Study Area chum stock by components for the period 1960 to 1987. The total Study Area origin chum stock in 1987 was estimated at 2,072,000 of which the total catch was 665,000 chum (32%) and the total escapement 1,406,000 (68%).

Table 15 compares the pre-season and in-season estimates of the Study Area chum returns with the actual post-season returns for the period 1969 to 1987. The Study Area stock size in 1987 was the lowest since 1984 and represents only 66% of the pre-season estimate and 90% of the in-season estimate. Although approximately one third of the returning Study Area chum stock was harvested, it is important to note that the large majority of this catch consisted of the enhanced stocks harvested terminally and the surplus wild stocks, and was not considered in the Clockwork harvest calculations.

Table 16 details the brood year production for all Study Area chum salmon for the period 1955 to 1982.

Migration Timing Through Johnstone Strait

The majority of returning Study Area chum salmon migrate through Johnstone Strait where the total return is assessed for stock timing, strength and composition. In general, the timing of the fall chum run through Johnstone Strait ranges from early September through late November. The 1987 test fishing CPUE data indicated a peak migration through the upper and mid Johnstone Strait during the second and third weeks of October (Table 7). This is similar to the peak timing of test catches in previous years which have generally ranged between October 5 and 12 with a mean date of October 9 (Luedke et al. 1988).

The timing of major stocks in Johnstone Strait was estimated by combining the upper Johnstone Strait test fishing CPUE data and electrophoretic results (Fig. 4). This approach indicates two dominant Fraser River component peaks. The first was observed in late September (week 9/4) and may reflect the passage of early timing stocks (e.g., Chehalis and Stave Rivers). The second peak was observed in mid-October (weeks 10/2 and 10/3) and likely reflects the passage of late arriving Fraser River stocks (e.g., Chilliwack River). The peak abundance of non-Fraser Study Area stocks occurred in mid-October (week 10/2) and likely

Table 15. Comparison of pre-season and in-season estimates of Study Area chum returns with actual (post-season) returns, 1969 - 1987.

	Total Study Area Chum Returns				Difference (Pre-Season - Total Stock)		Difference (In-Season - Clockwork Assessed Stock)	
YEAR	Pre-Season (1)	In-Season (2)	Clockwork Assessed Stock (3)	Total Study Area Stock(3)	Error(4)	%(5)	Error(4)	%(5)
1969	1,597,000	NA	1,747,100	1,739,400	142,400	8.2%		
1970	1,876,000	NA	2,228,000	2,214,600	338,600	15.3%		
1971	1,573,300	NA	837,100	847,500	(725,800)	85.6%		
1972	1,515,000	NA	4,071,100	4,111,100	2,596,100	63.1%		
1973	3,900,000	NA	4,729,800	4,726,600	826,600	17.5%		
1974	1,554,000	NA	1,804,200	1,843,900	289,900	15.7%		
1975	1,350,000	NA	1,259,100	1,269,700	(80,300)	6.3%		
1976	3,600,000	NA	2,164,300	2,207,300	(1,392,700)	63.1%		
1977	2,577,000	NA	1,659,200	1,668,400	(908,600)	54.5%		
1978	2,395,000	NA	3,171,000	3,142,000	747,000	23.8%		
1979	1,205,000	NA	862,800	862,900	(342,100)	39.6%		
1980	1,617,300	NA	2,450,900	2,456,500	839,200	34.2%		
1981	1,809,500	NA	1,492,300	1,493,200	(316,300)	21.2%		
1982	2,860,000	NA	3,056,500	2,992,300	132,300	4.4%		
1983	1,864,600	1,420,000	1,611,000	1,591,200	(273,400)	17.2%	191,000	11.9%
1984	1,701,800	1,810,000	1,918,100	1,949,300	247,500	12.7%	108,100	5.6%
1985	2,468,100	2,970,000	4,068,500	4,428,500	1,960,400	44.3%	1,098,500	27.0%
1986	2,773,900	3,806,000	3,789,000	3,878,000	1,104,100	28.5%	(17,000)	0.4%
1987	3,125,000	2,305,600	1,982,900	2,071,700	(1,053,300)	50.8%	(322,700)	16.3%
TOTAL AVG	2,177,000	2,462,300	2,363,300	2,394,400	753,500	31.5%	347,500	13.0%
1983-1987	2,386,700	2,462,300	2,673,900	2,783,700	927,700	33.3%	347,500	13.0%
EVEN YRS	2,210,333	2,808,000	2,739,233	2,755,000	854,156	31.0%	62,550	2.2%
ODD YRS	2,146,950	2,231,867	2,024,980	2,069,910	662,920	32.0%	537,400	21.0%

(1) Pre-season estimates include 100,000 U.S. fish; 1987 pre-season value from Table 3.

(2) In-season Clockwork stock estimate for 1987 from Table 4.

(3) Clockwork Assessed Stock and Total Study Area Stock from Table 13.

(4) Bracketed values indicate that actual value was below the estimate.

(5) Difference/Actual.

Table 16. Production of wild and enhanced Study Area chum salmon since 1955, in thousands.

Year	Esc (1)	Catch (2)	Total Return (3)	Age Composition(4) Age 3	4	5	Brood Return Age 3	4	5	Total	Percent Return at Age 3	4	5	R/E (5)
1955	612.7	578.3	1191.0				1071	1352	14	2438	43.9%	55.5%	0.6%	3.98
56	496.2	648.2	1144.4				695	913	25	1634	42.6%	55.9%	1.5%	3.29
57	1025.6	509.2	1534.8				589	1141	17	1747	33.7%	65.3%	1.0%	1.70
58	1143.0	1321.2	2464.2	43.5%	56.5%	0.0%	145	191	5	341	42.5%	55.9%	1.6%	0.30
59	899.4	1195.0	2094.4	33.2%	64.6%	2.2%	798	677	8	1483	53.8%	45.6%	0.5%	1.65
60	742.2	774.2	1516.5	38.9%	60.2%	0.9%	365	841	11	1217	30.0%	69.1%	0.9%	1.64
61	646.7	664.7	1311.4	11.1%	87.0%	1.9%	252	295	9	557	45.2%	53.1%	1.7%	0.86
62	713.7	292.1	1005.8	79.4%	19.0%	1.7%	171	884	12	1067	16.0%	82.9%	1.1%	1.50
63	689.7	357.7	1047.4	34.9%	64.6%	0.5%	195	329	14	538	36.2%	61.2%	2.6%	0.78
64	899.5	200.4	1099.9	22.9%	76.4%	0.7%	575	2296	64	2934	19.6%	78.3%	2.2%	3.26
65	401.3	75.8	477.1	35.8%	61.9%	2.3%	466	877	21	1364	34.2%	64.3%	1.5%	3.40
66	994.0	94.1	1088.1	17.9%	81.2%	0.9%	799	2005	92	2895	27.6%	69.3%	3.2%	2.91
67	709.3	206.4	915.7	62.7%	35.9%	1.3%	189	402	76	667	28.3%	60.3%	11.4%	0.94
68	1886.5	889.6	2776.1	16.8%	82.7%	0.5%	354	3742	784	4879	7.2%	76.7%	16.1%	2.59
69	1087.3	652.1	1739.4	45.9%	50.4%	3.7%	293	3818	482	4594	6.4%	83.1%	10.5%	4.23
70	1161.7	1052.9	2214.6	8.5%	90.5%	0.9%	125	979	43	1146	10.9%	85.4%	3.7%	0.99
71	678.2	169.2	847.5	41.7%	47.5%	10.8%	376	492	32	900	41.8%	54.7%	3.5%	1.33
72	1833.9	2277.3	4111.2	7.1%	91.0%	1.8%	734	1849	37	2620	28.0%	70.6%	1.4%	1.43
73	1572.1	3154.5	4726.6	2.6%	80.8%	16.6%	327	1240	65	1632	20.0%	76.0%	4.0%	1.04
74	1222.3	621.6	1843.9	20.4%	53.1%	26.2%	391	2628	145	3164	12.4%	83.1%	4.6%	2.59
75	667.4	602.3	1269.7	57.8%	38.8%	3.4%	449	405	19	872	51.5%	46.4%	2.1%	1.31
76	947.4	1259.9	2207.3	14.8%	83.8%	1.4%	314	1743	100	2157	14.5%	80.8%	4.6%	2.28
77	1440.7	227.7	1668.4	23.4%	74.3%	2.2%	695	1187	135	2016	34.5%	58.9%	6.7%	1.40
78	1410.7	1731.3	3142.0	14.3%	83.7%	2.1%	207	2239	423	2868	7.2%	78.0%	14.8%	2.03
79	758.3	104.5	862.9	36.4%	46.9%	16.8%	619	889	89	1597	38.8%	55.7%	5.6%	2.11
80	1325.1	1131.4	2456.5	28.3%	71.0%	0.8%	278	897	99	1274	21.8%	70.4%	7.8%	0.96
81	1291.1	202.0	1493.2	13.8%	79.5%	6.7%	960	2680	354	3993	24.0%	67.1%	8.9%	3.09
82	1480.0	1512.2	2992.3	20.7%	74.8%	4.5%	1650	3164	274	5088	32.4%	62.2%	5.4%	3.44
83	1232.9	358.3	1591.2	17.5%	55.9%	26.6%	388	1575						
84	1595.2	354.1	1949.3	49.2%	46.0%	4.5%	222							
85	2698.2	1730.4	4428.5	37.3%	60.5%	2.2%								
86	2097.7	1780.2	3878.0	10.0%	81.6%	9.1%								
87	1406.2	665.5	2071.7	10.7%	76.0%	13.2%								
AVERAGE	1144.4	830.1	1974.6	28.6%	65.9%	5.5%	489.7	1439.0	123.1	2060.1	28.8%	66.6%	4.6%	2.04
EVEN YR	1246.8	996.3	2243.1	24.5%	65.7%	3.5%	468.2	1740.7	150.9	2377.5	22.3%	72.7%	4.9%	2.09
ODD YR	1048.1	673.8	1721.8	27.3%	54.4%	6.5%	511.1	1157.4	95.2	1742.7	35.2%	60.5%	4.3%	1.99

(1) Escapement is Total Escapement (wild and enhanced) from Table 13.

(2) Catch is Total Study Area Catch from Table 13.

(3) Total return = Total Study Area Catch + Escapement.

(4) Age composition from Johnstone Strait test fishery samples, except 1958-64,72,73 when commercial fishery samples were used.

(5) R/E = Total return from brood / Brood escapement.

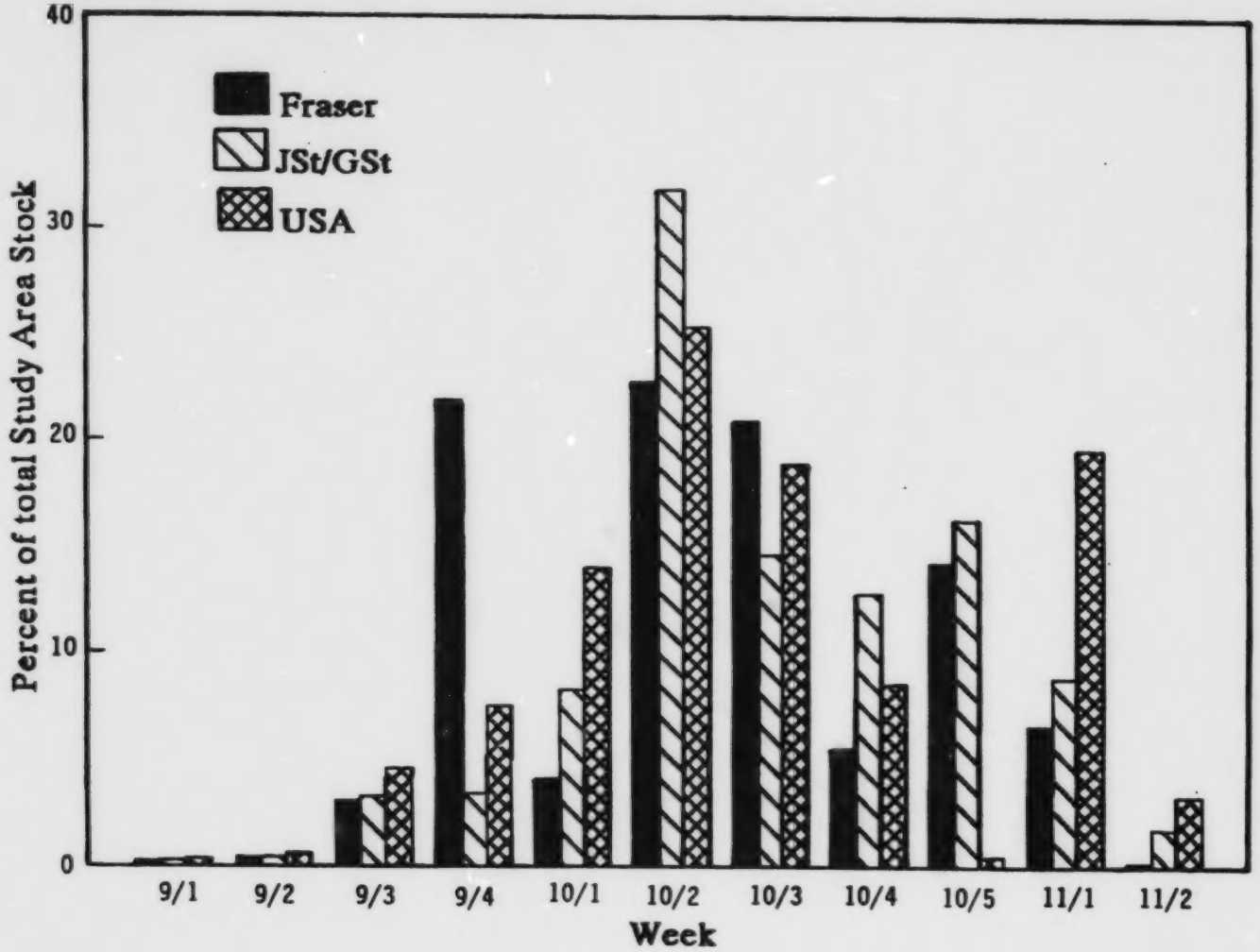

Fig. 4. Weekly chum stock composition in the upper Johnstone Strait chum test fishery, 1987.

corresponds to the migration of Mid Vancouver Island enhanced stocks. American chum also showed a dominant migration peak during the week 10/2.

Fraser River Chum Returns

The post-season estimate of the total Fraser River chum return in 1987 was 575,000 (Table 17), or 28% of the total Study Area stock. This post-season estimate was well below the pre-season estimate of 951,000 (Table 9). The total Fraser River chum stock size for 1987 consisted of the catch component of 145,000 chum, as determined from catch and GSI information, and the total escapement of 430,000 chum (wild spawners plus fish used for broodstock purposes, Table 17). This represents a harvest rate of 25% on a stock that returned at below the escapement target of 700,000.

Timing information on the return of the Fraser River chum run past Cottonwood, as determined by the test fishing CPUE data, suggested a strong early component in mid-October, followed by a weaker late component in the third and fourth weeks of November. Similar migration peaks were observed in the upper test fishing area at Albion.

Mid Vancouver Island Chum Returns

Table 18 shows the estimated catches, escapements, total returns and harvest rates for the Mid Vancouver Island enhanced chum stocks for the period 1978 to 1987. In 1987, the total enhanced return was estimated at 419,000. This is below the pre-season estimate of 669,000 but close to the in-season estimate of 494,000 (Table 9).

CLOCKWORK EVALUATION

The primary objective of the Clockwork management strategy is to rebuild the wild chum stocks within a defined time frame to the estimated optimum escapement levels by limiting the annual harvest rates. Interim wild escapement targets have been developed in stages towards the postulated escapement optimum. This objective of rebuilding the stocks is accomplished within a stepped harvest rate strategy which is applied against in-season estimates of the assessed Clockwork total run size. In simple terms, evaluating the success of the Clockwork plan involves determining if the desired harvest rate was achieved and the interim escapement goal reached; Table 19 summarizes most evaluation criteria. Integral in this, however, is the ability to assess accurately the size of the returning Study Area chum run. This involves accurate determinations of the in-season catch, assessment of stock size, stock identification and harvest rates.

The Clockwork management strategy focuses exclusively on stocks which migrate through Johnstone Strait. Although this likely represents,in most years, over 90% of the total Study Area stock, there are some returning chum which migrate through the southern route via Juan de Fuca Strait. The Clockwork evaluation assesses only the estimated northerly migrating stock. Table 1 details the differences which may be noted between the Total Clockwork Assessed Stock and the Total Study Area Stock. For example, the Total Clockwork Assessed

Table 17. Harvest, escapement and harvest rate of Fraser River origin chum salmon, 1951-1987.

Year	Johnstone Strait (1)	Georgia Strait	West Coast (2)	-------U.S.------ 7 & 7A	4B,5,6C	All Fraser Harvest (3)	Total Harvest	Total Escapement	Total Stock	Harvest Rate
1951	523,874	NA	302	0	23	491,815	1,015,991	171,725	1,187,716	86%
1952	191,249	NA	108	0	0	559,393	750,750	176,250	927,000	81%
1953	465,021	NA	404	0	0	331,804	797,229	137,225	934,454	85%
1954	590,473	NA	253	0	0	457,750	1,048,476	86,375	1,134,851	92%
1955	143,565	NA	759	0	9	103,297	247,621	110,500	358,121	69%
1956	155,668	NA	61	0	0	72,958	228,687	32,925	261,612	87%
1957	92,528	NA	123	0	48	124,319	216,970	84,630	301,600	72%
1958	252,287	NA	1,178	0	690	202,075	455,540	89,375	544,915	84%
1959	218,898	NA	1,448	0	996	237,091	457,437	152,300	609,737	75%
1960	146,889	NA	4,614	21,523	185	77,262	250,473	263,700	514,173	49%
1961	65,963	NA	5,895	15,803	20	57,545	145,225	172,700	317,925	46%
1962	36,568	NA	8,034	8,741	33	58,870	112,246	180,200	292,446	38%
1963	75,293	NA	9,166	9,807	360	64,548	159,174	214,200	373,374	43%
1964	27,470	NA	9,158	11,350	437	73,031	121,447	325,400	446,847	27%
1965	4,270	NA	8,713	5,595	203	19,329	38,110	184,800	222,910	17%
1966	8,860	NA	8,219	10,083	216	26,054	53,432	429,700	483,132	11%
1967	36,432	NA	11,939	9,206	688	55,343	113,608	213,873	327,481	35%
1968	298,253	NA	12,959	77,467	863	213,468	603,010	822,200	1,425,210	42%
1969	183,798	NA	6,816	39,026	735	93,231	323,606	390,100	713,706	45%
1970	209,072	NA	11,867	61,134	332	184,494	466,900	287,250	754,150	62%
1971	40,206	NA	9,162	19,848	193	25,674	95,083	290,150	385,233	25%
1972	444,705	NA	40,338	252,043	600	262,620	1,000,306	423,290	1,423,596	70%
1973	590,246	NA	52,910	200,744	643	201,114	1,045,657	267,105	1,312,762	80%
1974	101,667	NA	28,013	145,411	1,279	107,696	384,066	350,390	734,456	52%
1975	144,527	NA	17,876	69,307	262	80,442	312,415	191,445	503,860	62%
1976	343,629	NA	49,645	191,507	1,126	186,365	772,272	340,467	1,112,739	69%
1977	42,066	NA	8,227	38,846	626	23,144	112,909	599,371	712,280	16%
1978	485,439	NA	12,320	295,733	277	133,722	927,492	359,065	1,286,557	72%
1979	20,326	NA	2,114	3,455	403	15,666	41,963	255,634	297,597	14%
1980	243,146	NA	13,404	245,019	3,666	87,478	592,713	312,182	904,895	66%
1981	26,519	NA	3,207	5,814	771	19,908	56,219	435,345	491,564	11%
1982	235,896	NA	8,520	54,570	1,649	82,229	382,864	322,286	705,150	54%
1983	56,189	NA	84	1,671	4,899	25,059	87,901	367,363	455,264	19%
1984	19,756	NA	6,128	1,192	4,846	33,618	65,540	540,265	605,805	11%
1985	242,100	36,552	113,378	124,160	15,449	57,659	589,298	1,147,702	1,737,000	34%
1986	342,474	60,743	35,998	68,213	17,213	113,952	638,593	833,591	1,472,184	43%
1987	17,869	26,729	31,288	18,649	14,081	35,945	144,561	430,000	574,561	25%

(1) Includes estimated catch of Fraser Chum in Areas 11, 12, 13 commercial, test fisheries and Indian food fisheries in marine waters.
(2) Includes estimated catch in commercial and test fisheries in Areas 20 and 21.
(3) Includes commercial, test and Indian food fishery catches.

Table 18. Enhanced Mid Vancouver Island chum stock catches in Areas 12-14, escapements, total stock and harvest rates, 1978-1987.

	Areas 12-13		Area 14					
Year	Catch (1)	% of Total Catch	Catch(1)	% of Total Catch	Total Catch	Escapement(2)	Total Return	Harvest Rate
1978	184,200	66.6%	92,300	33.4%	276,500	124,600	401,100	69%
1979	0	0.0%	5,800	100.0%	5,800	127,000	132,800	4%
1980	24,700	25.3%	73,100	74.7%	97,800	93,200	191,000	51%
1981	0	0.0%	46,200	100.0%	46,200	82,000	128,200	36%
1982(3)	75,500	35.9%	134,800	64.1%	210,300	135,500	345,800	61%
1983	0	0.0%	104,300	100.0%	104,300	186,800	291,100	36%
1984	0	0.0%	176,700	100.0%	176,700	148,800	325,500	54%
1985	136,000	20.4%	532,300	79.6%	668,300	268,200	936,500	71%
1986	375,000	54.7%	310,200	45.3%	685,200	289,300	974,500	70%
1987	16,900	6.1%	259,600	93.9%	276,500	142,800	419,300	66%
Averages:	81,230	31.9%	173,530	68.1%	254,760	159,820	414,580	61.5%

(1) Estimated catches of MVI enhanced chum in Areas 12-14 determined through MRP (D. Bailey, pers. comm.).

(2) Escapement contribution calculated to include all returns to Big Qualicum, Little Qualicum and Puntledge River enhanced facilities plus an estimate of the contribution to wild spawning escapement by enhanced stock (D. Bailey, pers. comm.).

(3) The first Puntledge and Little Qualicum River enhancement production returns occurred in 1982. Prior to that time, all enhanced returns were from Big Qualicum River facility only.

Table 19. Clockwork assessment of in-season and post-season estimates, and the estimated and desired wild escapements, 1983 - 1987.

	CLOCKWORK ASSESSMENT 1983-87				
	1983	1984	1985	1986	1987
1. IN-SEASON					
Assessed Total Stock(1)	1,420,000	1,810,000	2,970,000	3,806,000	2,305,600
Desired HR	10.0%	10.0%	20.0%	30.0%	10.0%
Apparent HR	13.6%	5.7%	25.7%	36.7%	7.6%
2. POST-SEASON					
Total Clockwork Assessed Stock(2)	1,611,000	1,918,100	4,068,500	3,789,000	1,982,900
Clockwork Assessed Catch(3)					
COMM & TF A11-13	101,839	38,251	516,314	1,131,377	68,414
COMM & TF A29	7,778	1,976	51,800	97,241	9,633
COMM A 14 FR	61,817	22,451	36,552	60,743	26,729
IFF A11-13,29	20,322	39,541	18,621	28,866	48,571
US 7-7A	2,019	1,348	138,615	76,854	21,224
Total	193,775	103,567	761,902	1,395,081	174,570
Desired HR	10.0%	10.0%	30.0%	30.0%	10.0%
Actual HR	12.0%	5.4%	18.7%	36.8%	8.8%
3. ESCAPEMENT (WILD)					
Wild Goal	1,800,000	1,800,000	1,800,000	1,800,000	2,000,000
Wild Estimated	1,066,700	1,442,700	2,493,200	1,885,100	1,234,600
Difference (4)	(733,300)	(357,300)	693,200	85,100	(765,400)

(1) In-season Clockwork stock estimate for 1987 from Table 4.

(2) Total Clockwork Assessed Stock includes Total Clockwork Catch plus Escapement (Table 13).

(3) Clockwork Assessed Catch includes all commercial catches in Areas 11-13, 28 (after Sep 1), Area 14 Fraser origin catch and Area 29 (all catches), IFF catches in Areas 11-13 and 29, test fishery payment catches in Areas 11-13 and 29, and Canadian catch components in U.S. Areas 7 and 7A (see Table 1).

(4) Bracketed values indicate below goal escapement.

stock size for 1987 was 1,983,000 whereas the Total Study Area stock size was 2,072,000 (Table 13).

Catch Estimation

The only commercial fishery conducted in Johnstone Strait in 1987, was the one-day assessment fishery held during the fourth week of September. The post-season estimate of commercial catch for combined gear in that period was approximately 6% less than the in-season catch estimate. Although, this discrepancy is not large, it would have had the effect of overestimating the fall chum run.

In Area 14, fishing by gillnets and seines was conducted over a 5-week period, generally with only one gear type operating each week. Estimates of the in-season catch (field staff hails) in this fishery are often greater than the post-season sales slip estimates because of some unreported chum catch taken privately by fishermen. This problem in the past, has been most prevalent in the late or "clean-up" fishery. Generally, an estimate is made of the unreported catch and included in the catch summary. In 1987, although a clean-up fishery did not occur, the post-season catch was actually larger than the in-season estimate by approximately 22,700 chum (Table 20). Table 20 summarizes the non-reported catches in Areas 14, 17 and 18 during 1981 to 1987.

Stock Assessment

Two methods were used for in-season stock assessment: 1) correlation of the in-season commercial catch data with the historic catch and total stock information and 2) analysis of the pooled test fishing data for Johnstone Strait in Area 12. The first method has provided more accurate estimates of the total stock size. Unfortunately, the commercial fishery in Johnstone Strait in 1987 was limited to only one opening in September. The assessment of the catch data indicated an estimated Clockwork assessed stock size of 2.09 million (Table 4) which was similar to the final post-season estimate of 1.98 million (Table 13). Subsequent run size updates were based exclusively on the test fishing results and lead to a final in-season estimate of 2.31 million chum (Table 4). This was approximately 16% greater than the actual run size. Despite this error, the desired Clockwork harvest rate of 10% was not exceeded (Table 19).

The average difference between the in-season and post-season Clockwork assessed stock estimates for the 1983 to 1987 period was about 13% (Table 15). In comparison, the pre-season forecasts proved to be an understandably less accurate prediction of the final total Study Area stock estimates. The pre-season/post-season difference averaged 32% for the 1969 to 1987 period, with the 1987 pre-season forecast exceeding the actual run size by 51% (Table 15).

Harvest Rate

Table 19 compares the in-season and post-season assessment of the desired and actual harvest rates since the inception of the Clockwork program in 1983. The in-season data provide a measure of the fisheries managers' assessment at the time of implementing fisheries actions. During the 1987 season, regulations were implemented to limit the directed commercial chum harvesting in Johnstone Strait

Table 20. Annual non-reported, test (T) and sampled (S) catches for Areas 14, 17 and 18, 1981-1987.

	AREA 14				AREA 17		AREA 18		
	Non-rept.(1)		T and S(2)		Non-rept.	T and S	Non-rept.	T and S	
Year	GN	SN	GN	SN	GN	GN	GN	GN	TOTAL
1981	8,074	7,761			0		0		15,835
1982	11,350	14,274	Included		8,444	Included	1,521	Included	35,589
1983	46,210	26,211	in		0	in	0	in	72,421
1984	24,946	26,395	commercial		0	commercial	0	commercial	51,341
1985	29,950	0	catch		0	catch	0	catch	29,950
1986	0	39,214			0		0		39,214
1987	0	22,679			2,638		0		25,317

(1) Non-reported catch is the difference between in-season and post-season estimates. In-season estimates are from field hails and limited sales slip information. These catches are from directed fall chum fisheries only, and exclude test fishery payment catches, Indian food fishery catches and incidental catches in other fisheries. Post-season estimates are from BC Catch Statistics.

(2) Test and sampled catches are the fall chum from test fishery payment catches and GSI samples from Areas 14-19. Note that for these areas, GSI samples were generally taken from commercial catches, and so are included in those catches. For Johnstone Strait, both the test and sampled catches are also included in the commercial catches.

given the low in-season forecast of the run size (2.3 million chum, Table 19). Indian food fisheries and test fisheries were permitted given the understanding that these catches would not exceed the 10% Clockwork harvest rate ceiling. In-season, the estimate of the Johnstone Strait Clockwork harvest rate was 7.6%, based on the in-season catch estimates and the assessed total stock estimate. The post-season estimate of Clockwork harvest rate was 8.8%. This is because the post-season Clockwork assessed stock size was only 1.98 million, and catches were marginally higher than estimated in-season. The 1987 Clockwork harvest rate requirement of 10% or less was not exceeded.

CATCH ALLOCATION

The allocation of catch between gear types is a major management consideration in implementing the in-season fishing plans. The MAC allocation required that the Inside chum catch be split 65% and 35% between seines and gillnets, respectively. The in-season catch estimates for 1987 indicated that the recommended catch allocation goal had been achieved. However, the final post-season allocation based on sales slip records was 58% seine and 42% gillnet catch (Table 6). The majority of the catch in Areas 11-13 were taken by seines (80%), while virtually all of the catch in Areas 15-19 and 28-29 were taken by gillnets; Area 14 showed strong seine and gillnet catch components of 58% and 42%, respectively (Table 6).

AGE ANALYSIS

Chum age was determined from scale samples taken in the Area 12 test fishery (Table 21), and from scale samples taken in the Area 13 test fishery (Table 22). The weekly age compositions were weighted by the weekly CPUE to determine the seasonal age structure. Area 12 results were considered to be representative of the total Study Area stocks. The seasonally adjusted age composition of the Study Area chum in Area 12 was 11% age three, 76% age four and 13% age five (Table 21). Table 23 compares the annual age composition of the Study Area chum stocks for the period 1958 to 1987.

GENETIC STOCK IDENTIFICATION

The Genetic Stock Identification (GSI) program provides an estimate of stock composition in the chum salmon fisheries, identifies general stock timing and migration routes, and provides information on the magnitude of American origin stock in Canadian fisheries. This program has become an important domestic and international fisheries management tool.

The electrophoretic technique and sampling methodologies are described for 1987 in Naylor et al. (1988). In general, 150 chum salmon are sampled on a weekly or per fishery basis. Heart, liver and muscle tissues are collected and analyzed using the horizontal starch gel technique (Beacham et al. 1985). The sample results are applied to the total catch and the overall results used to discriminate between the major stock groups including the Study Area non-Fraser, Fraser River, American and West Coast Vancouver Island stocks.

In 1987, GSI samples for stock composition were collected from test or commercial fisheries in the following areas: Johnstone Strait fishery in Area

Table 21. Weekly age composition of chum stock in Johnstone Strait (Area 12), based on scale analysis of test fishing samples, 1987.

Week	Number Sampled	Age 3	Age 4	Age 5	Age 6	% At Age 3	% At Age 4	% At Age 5	% At Age 6	CPUE	% TOTAL	Weighted % At Age(1) 3	Weighted % At Age(1) 4	Weighted % At Age(1) 5	Weighted % At Age(1) 6
VESSEL # 1	PACIFIC FAITH														
9/1															
9/2															
9/3	95	6	53	36	0	6.3%	55.8%	37.9%	0.0%	101.0	5.7%	0.4%	3.2%	2.1%	0.0%
9/4	92	4	74	14	0	4.3%	80.4%	15.2%	0.0%	179.6	10.1%	0.4%	8.1%	1.5%	0.0%
10/1	96	11	69	16	0	11.5%	71.9%	16.7%	0.0%	121.7	6.8%	0.8%	4.9%	1.1%	0.0%
10/2	94	12	73	9	0	12.8%	77.7%	9.6%	0.0%	681.8	38.2%	4.9%	29.7%	3.7%	0.0%
10/3	90	13	69	8	0	14.4%	76.7%	8.9%	0.0%	200.3	11.2%	1.6%	8.6%	1.0%	0.0%
10/4	89	11	77	1	0	12.4%	86.5%	1.1%	0.0%	96.6	5.4%	0.7%	4.7%	0.1%	0.0%
10/5	92	11	78	3	0	12.0%	84.8%	3.3%	0.0%	217.6	12.2%	1.5%	10.3%	0.4%	0.0%
11/1	97	24	56	17	0	24.7%	57.7%	17.5%	0.0%	186.8	10.5%	2.6%	6.0%	1.8%	0.0%
% of Total										1785.4		12.8%	75.5%	11.8%	0.0%
VESSEL # 2	OCEAN PREDATOR														
9/1															
9/2															
9/3	93	4	53	35	1	4.3%	57.0%	37.6%	1.1%	24.2	1.8%	0.1%	1.0%	0.7%	0.0%
9/4	87	4	61	22	0	4.6%	70.1%	25.3%	0.0%	84.0	6.1%	0.3%	4.3%	1.5%	0.0%
10/1	88	5	70	13	0	5.7%	79.5%	14.8%	0.0%	102.1	7.4%	0.4%	5.9%	1.1%	0.0%
10/2	93	8	65	20	0	8.6%	69.9%	21.5%	0.0%	281.9	20.5%	1.8%	14.3%	4.4%	0.0%
10/3	93	10	76	7	0	10.8%	81.7%	7.5%	0.0%	334.1	24.3%	2.6%	19.9%	1.8%	0.0%
10/4	94	13	68	13	0	13.8%	72.3%	13.8%	0.0%	219.9	16.0%	2.2%	11.6%	2.2%	0.0%
10/5	85	5	75	5	0	5.9%	88.2%	5.9%	0.0%	255.0	18.6%	1.1%	16.4%	1.1%	0.0%
11/1	92	10	67	15	0	10.9%	72.8%	16.3%	0.0%	72.3	5.3%	0.6%	3.8%	0.9%	0.0%
% of Total										1373.5		9.0%	77.2%	13.7%	0.0%
BOTH VESSELS COMBINED															
9/1															
9/2															
9/3	188	10	106	71	1	5.3%	56.4%	37.6%	0.5%	62.6	4.0%	0.2%	2.2%	1.5%	0.0%
9/4	179	8	135	36	0	4.5%	75.4%	20.1%	0.0%	131.8	8.3%	0.4%	6.3%	1.7%	0.0%
10/1	184	16	139	29	0	8.7%	75.5%	15.8%	0.0%	111.9	7.1%	0.6%	5.4%	1.1%	0.0%
10/2	187	20	138	29	0	10.7%	73.8%	15.5%	0.0%	481.9	30.5%	3.3%	22.5%	4.7%	0.0%
10/3	183	23	145	15	0	12.6%	79.2%	8.2%	0.0%	267.2	16.9%	2.1%	13.4%	1.4%	0.0%
10/4	183	24	145	14	0	13.1%	79.2%	7.7%	0.0%	158.3	10.0%	1.3%	7.9%	0.8%	0.0%
10/5	177	16	153	8	0	9.0%	86.4%	4.5%	0.0%	236.3	15.0%	1.4%	12.9%	0.7%	0.0%
11/1	189	34	123	32	0	18.0%	65.1%	16.9%	0.0%	129.6	8.2%	1.5%	5.3%	1.4%	0.0%
% of Total										1579.5		10.7%	76.0%	13.2%	0.0%

(1) Weighted age composition = % at age X relative % CPUE.

Table 22. Weekly age composition of chum stock in Johnstone Strait (Area 13), based on scale analysis of test fishing samples, 1987(1).

Week	Number Sampled	Age 3	Age 4	Age 5	Age 6	% At Age 3	% At Age 4	% At Age 5	% At Age 6	CPUE	CPUE % TOTAL	Weighted % At Age(2) 3	Weighted % At Age(2) 4	Weighted % At Age(2) 5	Weighted % At Age(2) 6
VESSEL OCEAN CLOUD															
9/1															
9/2															
9/3															
9/4	88	3	64	21	0	3.4	72.7	23.9	0.0	102.5	2.7%	0.1%	2.0%	0.6%	0.0%
10/1	95	4	77	14	0	4.2	81.1	14.7	0.0	1059.2	28.1%	1.2%	22.8%	4.1%	0.0%
10/2	91	6	72	13	0	6.6	79.1	14.3	0.0	864.8	23.0%	1.5%	18.2%	3.3%	0.0%
10/3	84	13	65	6	0	15.5	77.4	7.1	0.0	211.0	5.6%	0.9%	4.3%	0.4%	0.0%
10/4	94	12	73	9	0	12.8	77.7	9.6	0.0	472.6	12.5%	1.6%	9.7%	1.2%	0.0%
10/5	77	8	63	6	0	10.4	81.8	7.8	0.0	430.3	11.4%	1.2%	9.3%	0.9%	0.0%
11/1	86	16	64	6	0	18.6	74.4	7.0	0.0	584.5	15.5%	2.9%	11.5%	1.1%	0.0%
11/2	79	15	53	11	0	19.0	67.1	13.9	0.0	41.8	1.1%	0.2%	0.7%	0.2%	0.0%
% OF TOTAL										3766.7		9.5%	78.7%	11.8%	0.0%

(1) The age composition data from Area 13 catches was not considered representative of Study Area stocks since CPUE in Area 13 possibly does not reflect Study Area chum abundance.

(2) Weighted age composition = % at age X relative % CPUE.

Table 23. Age composition of the Study Area chum stocks, 1958-1987.

Year	Age Composition (1)				TEST FISHERY RESULTS				COMMERCIAL RESULTS			
	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6	Age 3	Age 4	Age 5	Age 6
1958	43.5%	56.5%	0.0%	0.0%					43.5%	56.5%	0.0%	0.0%
1959	33.2%	64.6%	2.2%	0.0%					33.2%	64.6%	2.2%	0.0%
1960	38.9%	60.2%	0.9%	0.0%					38.9%	60.2%	0.9%	0.0%
1961	11.1%	87.0%	1.9%	0.0%					11.1%	87.0%	1.9%	0.0%
1962	79.4%	19.0%	1.7%	0.0%					79.4%	19.0%	1.7%	0.0%
1963	34.9%	64.6%	0.5%	0.0%					34.9%	64.6%	0.5%	0.0%
1964	22.9%	76.4%	0.7%	0.0%					22.9%	76.4%	0.7%	0.0%
1965	35.8%	61.9%	2.3%	0.0%	35.8%	61.9%	2.3%	0.0%				
1966	17.9%	81.2%	0.9%	0.0%	17.9%	81.2%	0.9%	0.0%				
1967	62.7%	35.9%	1.3%	0.0%	62.7%	35.9%	1.3%	0.0%	59.7%	37.7%	2.6%	0.0%
1968	16.8%	82.7%	0.5%	0.0%	16.8%	82.7%	0.5%	0.0%	21.8%	77.8%	0.3%	0.0%
1969	45.9%	50.4%	3.7%	0.0%	45.9%	50.4%	3.7%	0.0%	41.7%	53.7%	4.6%	0.0%
1970	8.5%	90.5%	0.9%	0.0%	8.5%	90.5%	0.9%	0.0%	8.1%	91.2%	0.6%	0.0%
1971	41.7%	47.5%	10.8%	0.0%	41.7%	47.5%	10.8%	0.0%				
1972	7.1%	91.0%	1.8%	0.0%					7.1%	91.0%	1.8%	0.0%
1973	2.6%	80.8%	16.6%	0.0%					2.6%	80.8%	16.6%	0.0%
1974	20.4%	53.1%	26.2%	0.4%	20.4%	53.1%	26.2%	0.4%	16.7%	52.2%	30.7%	0.4%
1975	57.8%	38.8%	3.4%	0.0%	57.8%	38.8%	3.4%	0.0%	58.2%	40.8%	1.0%	0.0%
1976	14.8%	83.8%	1.4%	0.0%	14.8%	83.8%	1.4%	0.0%	13.6%	85.3%	1.2%	0.0%
1977	23.4%	74.3%	2.2%	0.0%	23.4%	74.3%	2.2%	0.0%				
1978	14.3%	83.7%	2.1%	0.0%	14.3%	83.7%	2.1%	0.0%	15.6%	85.8%	2.1%	0.0%
1979	36.4%	46.9%	16.8%	0.0%	36.4%	46.9%	16.8%	0.0%				
1980	28.3%	71.0%	0.8%	0.0%	28.3%	71.0%	0.8%	0.0%	22.8%	76.2%	1.1%	0.0%
1981	13.8%	79.5%	6.7%	0.0%	13.8%	79.5%	6.7%	0.0%				
1982	20.7%	74.8%	4.5%	0.0%	20.7%	74.8%	4.5%	0.0%				
1983	17.5%	55.9%	26.6%	0.0%	17.5%	55.9%	26.6%	0.0%				
1984	49.2%	46.0%	4.5%	0.2%	49.2%	46.0%	4.5%	0.2%				
1985	37.3%	60.5%	2.2%	0.0%	37.3%	60.5%	2.2%	0.0%				
1986	10.0%	81.6%	9.1%	0.0%	10.0%	81.6%	9.1%	0.0%				
1987	10.7%	76.0%	13.2%	0.0%	10.7%	76.0%	13.2%	0.0%				
AVERAGE ALL YEARS	28.6%	65.9%	5.5%	0.0%	27.8%	65.5%	6.7%	0.0%	29.5%	66.7%	3.9%	0.0%
AVERAGE ODD YEARS	31.0%	61.6%	7.4%	0.0%	34.8%	57.1%	8.1%	0.0%	34.5%	61.3%	4.2%	0.0%
AVERAGE EVEN YRS	26.2%	70.1%	3.7%	0.0%	20.1%	74.8%	5.1%	0.1%	26.4%	70.1%	3.7%	0.0%
10 YR AV 78-87	23.8%	67.6%	8.7%	0.0%	23.8%	67.6%	8.7%	0.0%				

(1) Final age compositions are determined from test fishery samples, whenever possible. When test fishery samples are not available, commercial results are substituted.

12, Qualicum net fishery in Area 14, Nanaimo gillnet fishery in Area 17, Juan de Fuca Strait seine test fishery in Area 20, Nitinat net fishery in Area 21 and WCVI troll fishery. The results were originally presented in Naylor et al. (1988) but have been since revised based on a re-analysis of the baseline data (Hop Wo et al. 1989). The revised results are presented for each of the above areas in Tables 24 a-f.

In-season, the GSI results were used for Johnstone Strait to update the estimated run size of the Fraser River stock, and for Area 14 to minimize the catch of passing Fraser River and American origin chum. The Johnstone Strait sampling program in 1987 indicated that compared to previous years, the Fraser River chum component was relatively weak during the early September sampling period (Table 24a). This was also reflected in the poor escapement of early Fraser River chum and the year's total production.

The GSI samples for Area 14 collected in the commercial terminal fisheries, were divided into "inside" (sub-areas 14-4,5) and "outside" (sub-area 14-9) groups (Table 24 b). Unlike past years, the "inside" samples indicated elevated levels of Fraser River origin chum, while the "outside" samples from passing fisheries suggested relatively low numbers of Fraser River chum. The GSI analysis also indicated low levels of American origin chum salmon in both Johnstone Strait and Area 14 (Tables 24a and b).

The GSI results, aside from their in-season application, are used primarily post-season to evaluate the size of the various Study Area chum components, and to develop a database of stock composition and timing. The GSI results are also used to evaluate the effectiveness of the in-season measures to protect specific stocks and determine the effectiveness of the rationale behind timing of openings and stock forecasts (Luedke et al. 1988).

Table 24a. Weekly chum stock composition in Johnstone Strait (Areas 11-13) seine test fishery, 1987(1).

Week	Sample Date	Sample Size	STOCK COMPOSITION FR %	FR (1SD)	JS,GS %	JS,GS (1SD)	U.S. %	U.S. (1SD)	Weekly total catch in Areas 11-13(2)	Catch by Stock(3) FR	JS,GS	U.S.
9/1	05-Sep-87		No Sample						3,734	950	2,627	157
9/2	12-Sep-87		No Sample						0	0	0	0
9/3	19-Sep-87	271	25.43	(10.5)	70.31	(10.2)	4.19	(4.8)	1	0	1	0
9/4	26-Sep-87	300	69.15	(11.4)	28.18	(11.4)	2.64	(5.3)	51,515	13,109	36,246	2,160
10/1	03-Oct-87	283	15.09	(14.2)	79.18	(13.6)	5.69	(6.1)	2	1	1	0
10/2	10-Oct-87	332	20.96	(10.7)	76.52	(10.6)	2.59	(4.4)	0	0	0	0
10/3	17-Oct-87	300	34.15	(13.4)	62.41	(12.3)	3.43	(4.0)	3,275	686	2,504	85
10/4	24-Oct-87	300	13.93	(9.9)	83.64	(9.9)	2.37	(4.4)	8,000	2,732	4,993	274
10/5	31-Oct-87	299	25.06	(11.8)	74.83	(11.2)	0.09	(2.5)	0	0	0	0
11/1	07-Nov-87	300	20.66	(10.5)	72.53	(10.2)	6.84	(4.8)	0	0	0	0
11/2	14-Nov-87	160	4.49	(14.7)	88.62	(15.8)	6.99	(6.3)	1,887	390	1,368	129
								Total	68,414	17,869	47,740	2,805
								% Stock		26.1%	69.8%	4.1%

(1) Stock composition from electrophoretic analysis of samples taken in test fisheries. Point estimate (%) for week and standard deviation (1SD) from bootstrap simulation.
Area: FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S - Washington State.

(2) Catch from BC Catch Statistics; Area 13 catch does not include Bute Inlet.

(3) Catch by stock = weekly catch X weekly stock composition in the previous week (due to the relative timing of commercial and test fisheries), except for weeks 9/1 and 9/2 where the point estimate from week 9/3 was used.

Table 24b. Weekly chum stock composition in Mid Vancouver Island (Area 14) commercial fishery, 1987(1).

Week	Week Ending	Sub-areas Sampled	Sample Size	Gear	STOCK COMPOSITION FR %	FR (1SD)	JS,GS %	JS,GS (1SD)	U.S. %	U.S. (1SD)	Weekly Catch(2) GN	SN	Total	Catch by Stock(3) FR	JS,GS	U.S.
10/3	17-Oct-87	14-4,5	139	GN	20.81	(13.9)	79.07	(14.9)	0.09	(4.8)	45,296	TF(27)	45,323	9,434	35,847	41
10/3	17-Oct-87	14-9	150	GN	5.50	(12.1)	90.64	(12.7)	3.83	(5.1)	19,616		19,616	1,079	17,786	752
10/4	24-Oct-87	14-4,5	150	SN	0.90	(8.3)	97.61	(8.5)	1.47	(5.2)		22,315	22,315	201	21,786	328
10/4	24-Oct-87	14-9	132	SN	0.20	(11.9)	99.72	(12.1)	0.06	(1.0)		34,208	34,208	68	34,119	21
10/5	31-Oct-87	14-4,5	165	GN(4)	1.16	(12.2)	95.21	(12.6)	3.56	(3.2)	49,355	26,027	75,382	875	71,822	2,685
10/5	31-Oct-87	14-9	150	GN	0.71	(7.9)	99.36	(8.1)	0.11	(3.5)	11,412	7,226	18,638	132	18,485	20
11/1	07-Nov-87	14-4,5	150	SN	2.53	(14.1)	92.38	(14.8)	5.09	(4.5)		87,995	87,995	2,226	81,290	4,479
11/1	07-Nov-87	14-9	150	SN	10.44	(12.0)	82.42	(11.3)	7.10	(6.7)		49,005	49,005	5,118	40,406	3,481
11/2	14-Nov-87	14-4,5	151	GN	34.66	(16.5)	65.24	(16.4)	0.05	(2.9)	21,678		21,678	7,517	14,150	11
11/2	14-Nov-87	14-9				No Sample (5)					1,396		1,396	77	1,252	67
11/3	21-Nov-87	14-9	118	SN(6)	0.57	(9.3)	97.03	(9.2)	2.55	(2.3)						
											Total		330,233	26,729	336,943	11,885
											% Stock			8.1%	102.0%	3.6%

(1) Stock composition from electrophoretic analysis of samples taken in commercial gillnet and seine fisheries. Samples taken as fish transferred to packers. Point estimate (%) for week and standard deviation (1SD) from bootstrap simulation.
Gear: GN - Gillnet, SN - Seine; TF - test fishery. Area: FR - Fraser; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State.

(2) Catch from BC Catch Statistics. Troll catches added to GN in weeks 10/3, 10/5 and 11/2 and to SN in week 10/4. Includes non-reported catch from Table 18.

(3) Catch by stock = weekly catch (SN + GN) X weekly stock composition.

(4) No SN sample from the commercial fishery in week 10/5, so GN point estimate was used to calculate catch by stock.

(5) No sample in sub-areas 14-9 for week 11/2, so used average of weeks 11/1 and 11/3 to calculate catch by stock.

(6) Comox sample for week 11/3 from DFO chartered seine vessel.

Table 24c. Weekly chum stock composition in the Strait of Georgia (Area 17) commercial gillnet fishery, 1987(1).

			STOCK COMPOSITION							Catch by Stock (3)		
			FR		JS,GS		U.S.					
Week	Sample Date	Sample Size	%	(1SD)	%	(1SD)	%	(1SD)	Weekly Catch(2)	FR	JS,GS	U.S.
11/2	Nov 9-10	135	0.3	(13.6)	82.7	(14.9)	17.0	(8.4)	9,022	29	7,461	1,532
									% Stock	0.3%	82.7%	17.0%

(1) Stock composition from electrophoretic analysis of samples taken in commercial fisheries. Point estimate (%) for week and standard deviation (1SD) from bootstrap simulation.
Area: FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State.

(2) Catch from BC Catch Statistics.

(3) Catch by stock = weekly catch X weekly stock composition.

Table 24d. Weekly chum stock composition in Juan de Fuca Strait (Area 20) seine test fishery, 1987(1).

Week	Week Ending	Sample Size	STOCK COMPOSITION FR %	FR (1SD)	JS,GS %	JS,GS (1SD)	WCVI %	WCVI (1SD)	U.S. %	U.S. (1SD)	Catch GN	Catch SN	Catch TR	Weekly Catch(2)	Catch by Stock(3) FR	GS	WCVI	U.S.
	to Aug. end				No Sample						161	499	1	661	512	102	22	2
9/1	05-Sep-87				No Sample						272	192		464	360	71	16	2
9/2	12-Sep-87				No Sample						48	6		54	42	8	2	0
9/3	19-Sep-87				No Sample							46		46	36	7	2	0
9/4	26-Sep-87	123	77.51	(16.8)	15.38	(16.2)	6.54	(10.7)	0.60	(8.2)		132		132	102	20	9	1
10/1	03-Oct-87	149	59.39	(18.4)	19.57	(16.6)	0.09	(5.1)	20.93	(12.0)	4254	9500		13,754	8,170	2,692	12	2,879
10/2	10-Oct-87	150	41.31	(14.5)	20.37	(12.5)	13.92	(9.3)	24.38	(8.3)		1127		1,127	466	230	157	275
10/3	17-Oct-87	150	31.28	(13.7)	37.29	(13.7)	7.43	(9.4)	24.14	(9.8)		1303		1,303	407	485	97	314
10/4	24-Oct-87	150	0.49	(9.0)	38.69	(12.8)	17.21	(11.1)	43.61	(7.5)		1276		1,276	6	494	220	556
10/5	31-Oct-87	149	27.50	(14.7)	32.97	(12.6)	5.88	(11.2)	33.68	(10.2)		1621		1,621	446	534	95	546
11/1	07-Nov-87	150	11.46	(9.8)	25.81	(12.3)	5.28	(8.1)	57.46	(14.5)		710		710	81	183	37	408
									Total		4735	16412	1	21,148	10,628	4,827	669	4,984
									% Stock						50.3%	22.8%	3.2%	23.6%
									Fall Chum		4574	15913	0	20,487	10,115	4,725	646	4,981
									% Stock						49.4%	23.1%	3.2%	24.3%

(1) Stock composition from electrophoretic analysis of samples taken in test fisheries. Point estimate (%) for week and standard deviation (1SD) from bootstrap simulation.
Area: FR - Fraser River, JS,GS - Johnstone Strait, Strait of Georgia, WCVI - West Coast Vancouver Island, U.S. - Washington State.

(2) Catch from BC Catch Statistics.

(3) Catch by stock = weekly catch X weekly stock composition. For weeks prior to 9/3 when no test fishery occurred, the point estimate for week 9/4 was used.

Table 24e. Weekly chum stock composition in Nitinat (Area 21) commercial fishery, 1987(1).

Week	Sample Date	Gear	Sample Size	STOCK COMPOSITION FR %	FR (1SD)	JS,GS %	JS,GS (1SD)	U.S. %	U.S. (1SD)	WCVI %	WCVI (1SD)	Weekly Catch(2)	Catch By Stock(3) FR	JS,GS	U.S.	WCVI
10/1	Sep 30-Oct 2	GN	91	5.7	(10.4)	7.8	(10.0)	4.6	(5.8)	81.9	(11.9)	29,530	1,683	2,303	1,358	24,185
10/2	Oct 9	GN	150	0.2	(6.8)	23.1	(10.3)	7.1	(6.4)	69.7	(9.5)	59,909	120	13,825	4,249	41,715
10/3	Oct 13	SN	149	0.3	(5.1)	18.7	(13.3)	0.0	(0.0)	81.0	(14.2)	139,874	420	26,156	0	113,298
	Oct 15-16	GN	150	5.7	(7.9)	10.2	(10.9)	0.2	(2.7)	83.9	(11.4)	32,954	1,878	3,361	66	27,648
10/4	Oct 21-22	GN	125	7.2	(6.0)	0.1	(8.6)	0.0	(0.0)	92.6	(9.2)	8,524	614	9	0	7,901
	Oct 22-23	SN	150	4.2	(4.1)	6.3	(4.8)	0.0	(0.9)	89.5	(5.7)	104,113	4,373	6,559	0	93,181
10/5	Oct 29	TS	149	2.2	(8.6)	2.8	(7.5)	1.8	(1.7)	93.2	(10.5)	426	9	12	8	397
11/1	Nov 4 (4)	GN	20	Sample Too Small To Process								4,950	807	1,272	688	2,183
	Nov 4	SN	150	16.3	(12.4)	25.7	(14.7)	13.9	(7.0)	44.1	(13.1)	15,133	2,467	3,889	2,103	6,674
											Total	395,413	12,371	57,387	8,473	317,182
											% Stock		3.1%	14.5%	2.1%	80.2%

(1) Stock composition from electrophoretic analysis of samples taken in commercial fisheries and one sample (Oct. 29) taken from a seine test fishery. Samples taken as fish transferred to packers. Point estimate (%) for week and standard deviation (1SD) from bootstrap simulation.
Gear: GN - gillnet, SN - seine, TS - test seine.
Area: FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State; WCVI - West Coast Vancouver Island.

(2) Catch from BC Catch Statistics.

(3) Catch by stock = weekly catch X weekly stock composition.

(4) Catch by stock (GN) for week 11/1 calculated using seine estimates.

Table 24f. Weekly chum stock composition in West Coast Vancouver Island test and commercial troll fisheries, 1987(1).

Week	Sample Date	Fishery	Sample Size	STOCK COMPOSITION FR %	FR (1SD)	JS,GS %	JS,GS (1SD)	WCVI %	WCVI (1SD)	U.S. %	U.S. (1SD)	QCI/NC/CC %	QCI/NC/CC (1SD)
							AREA 111						
7/2,7/3	Jul 7-20	TT	70	59.8	(21.3)	1.1	(12.3)	0.2	(0.8)	0.3	(3.9)	38.7	(21.9)
7/4,7/5	Jul 21-28	TT	90	45.2	(16.7)	0.6	(9.3)	0.2	(5.0)	0.1	(2.7)	53.9	(17.1)
							AREAS 123 - 126						
8/1	Jul 16-Aug 11	CT	129	7.9	(14.0)	0.8	(10.3)	25.7	(13.2)	3.4	(10.3)	62.1	(17.9)
							AREA 127						
7/2	Jul 5-11	CT/TT	160	62.5	(21.8)	1.1	(9.5)	0.1	(2.9)	0.0	(1.5)	36.5	(17.6)
7/3	Jul 11-18	TT	206	0.5	(8.9)	0.3	(7.4)	0.0	(2.2)	0.0	(0.0)	99.4	(11.4)
7/4	Jul 19-25	TT	157	18.4	(11.0)	0.2	(4.9)	0.1	(3.7)	0.0	(1.2)	81.3	(11.5)
7/5	Jul 26-31	TT	108	5.2	(13.8)	13.1	(11.8)	0.4	(6.3)	0.3	(5.7)	81.3	(12.4)
8/1	Aug 4	TT	41	0.2	(9.3)	0.2	(7.0)	41.7	(25.5)	0.0	(0.8)	58.0	(23.6)

(1) Stock composition from electrophoretic analysis of samples taken in test and commercial fisheries. Point estimate (%) for week and standard deviation (1SD) from bootstrap simulation.
Catch by Stock not available.
Fishery: TT - test troll; CT - commercial troll.
Area: FR - Fraser River; JS,GS - Johnstone Strait, Strait of Georgia; U.S. - Washington State; QCI/NC/CC - Queen Charlotte Islands, North Coast, Central Coast.

SUMMARY

1. The pre-season forecast of the total Study Area chum stock for 1987 was 3,125,000. This included 1,775,000 wild, 1,250,000 enhanced and 100,000 U.S. origin chum.

2. The final in-season Clockwork estimate of the total chum returning through Johnstone Strait was 2,305,600. This limited the Clockwork harvest rate to a maximum of 10%, and restricted the commercial harvesting in Johnstone Strait to a single assessment fishery conducted in late September. Surplus stock was harvested in terminal fisheries, with five openings held in the Qualicum terminal fishery (Area 14), and one opening in each of the Nanaimo (Area 17) and Cowichan (Area 18) fisheries.

3. The total catch of Study Area origin chum in 1987 was 665,000. Catch components included the commercial fishery and test fishery payment catches in the Study Area (446,000), the IFF catch (83,700), Area 20 and 21 catches (84,600), U.S. catches in Areas 4B, 5, 6C, 7 and 7A (38,800) and the non-reported catches and hatchery rank sales (25,400), less the U.S. origin chum catch of 13,400.

4. The above commercial catch in the Study Area of 446,000 chum was dominated by the Qualicum fishery (353,000 chum or 79% of the total) and the Johnstone Strait fishery (68,400 chum or 15% of total). The remaining 6% of the commercial catch came from the Nanaimo (10,000), Cowichan (5,400) and Fraser River (9,700) areas.

5. The post-season estimate of the Clockwork assessed stock was 1.98 million. The post-season estimate of the total Study Area chum stock was 2.07 million (665,000 or 32% was catch and 1.4 million or 68% was escapement); this total was below the pre-season estimate of 3.1 million and below the in-season estimate of 2.3 million.

6. The total Study Area escapement of 1.4 million chum (88% wild and 12% enhanced spawners) was below the interim escapement goal of 2.0 million set for 1987, and was the lowest escapement since the inception of the Clockwork program in 1983.

7. The Fraser River post-season stock estimate of 575,000 chum was well below the pre-season estimate of 951,000 chum and below the spawning requirement of 700,000. Although no commercial openings on chum were permitted in the river in 1987, a harvest rate of 25% was calculated for the Fraser River chum stock that year.

8. The total return of enhanced mid Vancouver Island chum stocks in 1987 was 419,000. This was close to the in-season estimate of 494,000 but below the pre-season estimate of 669,000.

9. The post-season estimate of Clockwork harvest rate was 8.8%, somewhat above the in-season estimate of 7.6%. This value was in accordance with the 1987 Clockwork harvest requirement of 10% or less.

10. The final post-season catch allocation by gear type showed 58% seine and 42% gillnet catch, compared to the required 65/35 seine to gillnet catch ratio.

11. The age composition of the Study Area chum for 1987 was 11% age three, 76% age four and 13% age five.

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APPENDICES

APPENDIX A. FRASER RIVER CHUM SALMON HARVEST MANAGEMENT PLAN, 1987.

INTRODUCTION

The original Clockwork management plan for the Study Area was implemented over three years (1984-1986) and dictated that the number of commercial fishery openings for chum in the Fraser River be linked directly to the number of openings in Johnstone Strait. This approach proved unsatisfactory because fisheries in the Fraser River were not managed on the basis of the number of chum entering the river. For example, in 1985, a harvestable surplus was available in the Fraser River but not in Johnstone Strait, which is managed on the abundance of all stocks combined. However, the direct linking of fishing days did not permit a harvest of the available surplus in the Fraser terminal area.

In recognition of the limitations of this approach, the South Coast Advisory Committee approved at a January 1987 meeting, the development of harvest strategies for South Coast terminal fishing areas. These strategies were part of the revised management plan for all Inside chum salmon. Under this new arrangement, terminal areas would be managed on the basis of actual abundance of fish in those areas rather than management actions within Johnstone Strait. This arrangement would provide a mechanism for managing terminal areas in accordance with the escapement requirements and fishing opportunities in those areas.

During the period of March to September 1987, the Department of Fisheries and Oceans, in consultation with the Fraser River Advisory Committee, developed specific details for the management of Fraser River chum salmon within the terminal fishing area. The management plan was reviewed at the South Coast Advisory Committee meeting on September 25, 1987. The following sections document the chum management plan for the Fraser River area.

BACKGROUND

Chum salmon returning to the Fraser River encounter three major management regimes before they reach the river. These are:

1. Johnstone Strait Clockwork,
2. Qualicum Clockwork and
3. Pacific Salmon Treaty.

Johnstone Strait Clockwork

The Johnstone Strait Clockwork permits a variable harvest rate to be applied to the mixture of all chum stocks passing through Johnstone Strait (Appendix Table A-1). Fraser River chum are often the dominant stock within the Strait and, on the average, will be harvested in this area at or near the allowable rate.

Appendix Table A-1. Stock size entering Johnstone Strait and appropriate harvest rates for the years 1987 to 1990.

Total Stock (millions)	Harvest Rate
0 - 3.0	10%
3.0 - 3.7	20%
3.7 - 5.2	30%
over 5.2	40%

Qualicum Clockwork

Some of the Fraser River chum which escape the Johnstone Strait fishery pass through the Qualicum fishing area. The catch of Fraser River chum in this fishery is limited by closing areas where Fraser chum are usually of highest abundance.

Pacific Salmon Treaty

Some of the returning Fraser River chum pass through the American waters and are harvested in the Juan de Fuca, San Juan Islands and Point Roberts areas. In 1987, the total harvest of chum, and therefore the harvest of Fraser River chum, was restricted in the San Juan and Point Roberts areas by the Chum annex of the Pacific Salmon Treaty.

The Fraser River Chum Salmon Harvest Management Plan was designed to protect those portions of the run which have already been harvested to the maximum amount in other areas, while permitting the harvest of those portions of the run which have surpluses.

Chum abundance within the Fraser River, the timing of commercial openings and projections of catch are determined by test fishing in the lower river at Cottonwood and in the upper river at Albion. The majority of the required run to the river is destined for spawning purposes and a smaller portion for Indian food and test fishing purposes. Any surpluses to these basic requirements may be harvested in directed commercial chum openings as permitted under the Fraser River Chum Salmon Harvest Management Plan.

Fraser River test fishing data assembled from 1963 to the present indicate that, on the average, there are two peaks of abundance each season, one in mid-October and one in late November. In order to ensure that the best available data are used for in-season management decisions on the Fraser River chum salmon, the total run is treated as two separate runs, termed early and late chum. This

approach provides the opportunity to harvest surpluses in either the early or the late portions of the run.

The following objectives and rules define the Fraser River chum harvest management plan.

FRASER RIVER CHUM MANAGEMENT

I. OBJECTIVES

The chum salmon management plan for the Fraser River area has five major objectives:

1. Determine and achieve the optimum escapement level in the Fraser River.

2. Harvest those chum over the gross escapement goal until such time as the optimum escapement level is determined.

3. Avoid overharvesting of specific stocks by harvesting over a broad period of time.

4. Minimize the catch of passing non-Fraser chum, as required.

5. Minimize the catch of other species, as required.

In order to implement a management plan to achieve these objectives, the following factors must be taken into account when establishing the required run size before directed chum fisheries can occur:

1. <u>Escapement Goal</u>

   To date, spawning escapements up to 900,000 have been observed, with great variation in early and late spawning population sizes. On average, the early and late run populations should be about equal in size. There are indications that larger spawning populations will result in larger returns and therefore larger catches. For the computational purposes of this plan, and to allow for larger escapements when the run to the river permits such escapements, the following schedule of escapement goals is used.

Appendix Table A-2. Schedule of escapement goals for Fraser River chum.

Run to River	Spawning Escapement Goal		
	Total	Early Run	Late Run
<800,000	700,000	365,000	335,000
801 - 850,000	730,000	380,000	350,000
851 - 900,000	760,000	395,000	365,000
901 - 950,000	785,000	410,000	375,000
951 - 1,000,000	810,000	420,000	390,000
1,000 - 1,050,000	835,000	430,000	405,000
1,051 - 1,150,000	860,000	450,000	410,000
1,151 - 1,250,000	960,000	500,000	460,000

2. Indian Food Fishery

To date, IFF catches have been up to 19,000 with the majority of the catch taken from the early portion of the run. For computational purposes of this plan, and allowing for larger catches as the run to the river increases, 15,000 early and 6,000 late chum are considered to be representative of the IFF catches.

3. Test Fishery

To date, test fishery catches have been up to 15,000. On average, the catch should be about equal between the early and late portions of the run. For computational purposes of this plan, and allowing for larger catches as the run to the river increases, 10,000 early and 9,000 late chum are considered to be representative of the test fishery catches.

4. Commercial Fishery

Since 1975, chum catches in the Fraser River commercial fisheries have averaged 38,000 (range 8,000 - 103,000) and have occurred in both the early and late periods of the run. For computational purposes of this plan, a commercial fishery within the Fraser River will be considered to harvest a minimum of 35,000 chum.

5. Run Timing

The run to the river will be assessed by test fishing at Cottonwood and Albion. The test fishery will be used to determine separately the status of the following two timing components:

Early run: October 1 - November 12
Late run: November 13 - December 20

6. Area of Fishing

Conservation measures are required for the following sub-areas (Fig. 3):

Sub-areas 29 - 1 to 6:

Howe Sound, other Canadian, and Puget Sound chum have been identified in Area 29 waters adjacent to the Fraser estuarial flats. The Canadian chum stocks are to be rebuilt and therefore, require conservation actions in this area. A further consideration in this area is the requirement of the Chum annex to the Pacific Salmon Treaty to limit the catch of Puget Sound chum in Canadian waters.

Sub-areas 29 - 7, 9 and 10:

The estuarial flats are an area where Fraser River chum may hold prior to entering the river. The number, and therefore the spawning escapement status of chum on the flats is not known and conservation actions in these areas are required. In addition, the fishing fleet adjacent to the outer boundary line may be difficult to control.

II. MANAGEMENT STRATEGY

The following rules and management strategies were developed with the above objectives and factors in mind and are to be used when managing Fraser River chum in 1987. The above factors should be reviewed by the South Coast Advisory Committee and necessary amendments made to the associated rules prior to the 1987 season.

1. The two runs to the Fraser River will be assessed and managed separately.

2. The gross escapement goal (see item 5 below) for each run will be increased as the run to the river increases.

3. There will be no directed harvesting of early or late run chum salmon within the Fraser River area unless the predicted run size, based on cumulative test fishing catches, will exceed the gross escapement goal (see item 5 below) for that portion of the run.

4. The catch prediction required before a directed chum fishery can occur is 35,000.

5. The chum run sizes required before directed harvesting can occur are calculated through the addition of three major components which form the gross escapement goal:

(i) Spawning escapement goal (Appendix Table A-2),
(ii) Indian food fishery catch estimate of 19,000 chum,
(iii) Test fishery catch estimate and the commercial fishery catch estimate of 35,000 for the combined early and late runs entering the Fraser River.

Run to River	Gross Escapement Goal		
	Total	Early Run	Late Run
800,000	740,000	390,000	350,000
801 - 850,000	770,000	405,000	365,000
851 - 900,000	800,000	420,000	380,000
901 - 950,000	825,000	435,000	390,000
951 - 1,000,000	850,000	445,000	405,000
1,000 - 1,050,000	875,000	460,000	415,000
1,051 - 1,150,000	900,000	470,000	430,000
1,151 - 1,250,000	1,000,000	520,000	480,000

6. The Fraser test fishery will be used to determine the timing of commercial openings.

Two test fisheries in the Fraser River are conducted for chum salmon stock assessment purposes and will be used to estimate the daily and seasonal total early and late chum abundances.

Commercial fisheries will be dependent upon the test fishery data indicating the required run size for the current timing period (early or late) as stated in item 5 above and showing a minimum average daily catch per unit effort of 6.0 immediately prior to the opening.

7. The standard fishing area will be inside the river.

The standard areas to be opened for directed chum harvesting are inside the river (sub-areas 29-11 through 29-17, Fig. 3). The lower boundaries in the Steveston, Canoe Pass, and North Arm areas will be amended to permit fishing within the river areas.

Those portions of Area 29 outside the river (i.e. sub-areas 29-1 through 29-10 inclusive, Fig. 3) will remain closed to directed

chum harvesting while Canadian and Puget Sound chum require conservation actions.

8. Chum openings will be a maximum of 24 hours duration.

In order to spread the impact of harvesting over a broad portion of the terminal run, the duration of a chum opening will be 24 hours unless there are small surpluses which would best be harvested in a shorter time period. A fishery for small surpluses would be for a minimum of about 12 hours.

9. Openings will be announced with up to 24 hours notice.

Whenever practical, an opening will be announced 24 hours prior to the start of the commercial fishery. Notices to Industry advising of run status and possible management actions will be issued whenever appropriate.

10. Chum fishing may be restricted before about October 15.

In those years when conservation concerns for chinook, coho or steelhead are identified, no directed harvesting of chum salmon surpluses will occur prior to October 15.

APPENDIX B. MID VANCOUVER ISLAND CHUM SALMON MANAGEMENT PLAN, 1987(1)

I. OBJECTIVES

1. Harvest bright fish to maximize economic return.

2. Maximize harvest of surplus coho to Big Qualicum and Puntledge Rivers.

3. Minimize harvest of adult chinook returning to Big Qualicum, Little Qualicum and Puntledge Rivers. Use mesh size and/or area restrictions as management strategies.

4. Limit the Fraser River interceptions to less than 10% in all Qualicum fishery catches.

5. Achieve Study Area 1987 MAC Allocation between gillnets and seines.

II. MANAGEMENT STRATEGY

1. The early season quota is determined to be approximately 75% of the expected surplus of wild and enhanced production returning to the Mid Vancouver Island area. This surplus is estimated as the total MVI return (wild and enhanced) less the required escapement (wild and enhanced) and less the MVI chum catch in Johnstone Strait. It should be noted that the early season quota for 1987 has been increased from 65% to 75%.

2. The total catch in the MVI clean-up fishery will be minimized. Every attempt will be made to reduce this number below 50 - 100,000 (Puntledge, Big Qualicum and Little Qualicum Rivers combined).

3. Gillnets and seines will fish at different times. The harvest by seines in the fishery will be a function of allocation.

4. The outer portions (beyond 5 miles) of sub-areas 14-5 and 14-4 (Fig. 3) will be closed until the clean-up fishery in order to restrict Fraser River chum interceptions.

5. Electrophoretic analysis will be conducted in all commercial openings, and the required fishing area alterations may be implemented in subsequent weeks.

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(1) Source: 1987 Chum Salmon Season South Coast Advisory Committee Meeting, September 25, 1987.

Appendix C. Weekly gear counts and days open in Areas 11-14, 16-18, and 20, 1987.

Week	Ending	AREA 11		AREA 12				AREA 13				AREA 14				AREA 16				AREA 17		AREA 18		AREA 20(1)			
		Gear	Days	Gear		Days		Gear		Days		Gear		Days		Gear		Days		Gear	Days	Gear	Days	Gear		Days	
		GN	GN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	SN	GN	GN	GN	GN	GN	SN	GN	SN
7/1	04-Jul																										
7/2	11-Jul																										
7/3	18-Jul																										
7/4	25-Jul																										
7/5	01-Aug																										
8/1	08-Aug	99	2.5	233	131	2.5	1.0	48	78	2.5	1.0			CLOSED				CLOSED									
8/2	15-Aug	25	2.5	428	135	2.5	2.0	16	37	2.5	2.0					41	15	2.0	2.0					100	122	2.0	2.0
8/3	22-Aug	97	2.5	239	202	2.5	1.0	7	148	2.5	1.0					23	43	2.5	1.0								
8/4	29-Aug	28	2.5	241	175	2.5	2.0	7	55	2.5	2.0					260	15	2.0	2.0					93	177	3.0	3.0
9/1	05-Sep	CLOSED		130	181	1.5	1.0	17	96	1.5	1.0					88	16	1.0	1.0					45	143	1.0	1.0
9/2	12-Sep																										
9/3	19-Sep																										
9/4	26-Sep (2)			397	237	1.5	1.0	105	125	1.5	1.0																
10/1	03-Oct																										
10/2	10-Oct																							200	121	1.0	1.0
10/3	17-Oct											633		2.0													
10/4	24-Oct												191		1.0												
10/5	31-Oct											727	311	1.0	1.2												
11/1	07-Nov												166		2.1												
11/2	14-Nov											355		1.0						181	1.0	90	1.0				
TOTAL			10.0			13.0	8.0			13.0	8.0			4.0	4.3			7.5	6.0		1.0		1.0			7.0	7.0

(1) During the fall fishing season, Area 20 had a separate 12-hr fishery for GN and SN to harvest surplus coho salmon. Daily gear counts from Pacific Salmon Commission were averaged to produce weekly gear counts for the fishing period.

(2) Assessment commercial fishery on chum in Johnstone Strait.

Appendix D. Weekly days open, gear counts and management regulations for fall chum fisheries in the Study Area, 1987.

Week Ending	Days GN	Days SN	Gear GN	Gear SN	Management Regulations
AREA 12					
05-Sep	1.5	1.0	130	181	Pink assesment opening. Fishing opportunities after this opening are determined by the Clockwork Management Strategy.
12-Sep	-		Closed		
19-Sep	-		Closed		
26-Sep	1.5	1.0	397	237	Chum assessment fishery as outlined by the Clockwork Management Strategy. Later than usual opening due to conservation of migrating pink salmon. Open to both gillnets and seines at 1600 hrs Sep 21 and closing to gillnets 0800 hrs Sep 23 and to seines 1600 hrs Sep 22. Sub-areas open include 12-1 to 12-13, a portion of 12-18 (east of a boundary from Lewis Pt. to Donegal Head), 12-21 and 12-24. Fall bunt size in effect (minimum 100 mm).
AREA 13					
05-Sep	1.5	1.0	17	96	Pink assesment opening. Fishing opportunities after this opening are determined by the Clockwork Management Strategy.
12-Sep	-		Closed		
19-Sep	-		Closed		
26-Sep	1.5	1.0	105	125	Chum assessment fishery as outlined by the Clockwork Management Strategy. Later than usual opening due to conservation of migrating pink salmon. Open to both gillnets and seines at 1600 hrs Sep 21 and closing to gillnets 0800 hrs Sep 23 and to seines 1600 hrs Sep 22. Sub-areas open include 13-7 to 13-10 (westerly of a boundary sign on Venture Pt.), 13-27 to 13-32, 13-35 and 13-40. Fall bunt size in effect (minimum 100 mm).
AREA 14					
17-Oct	2.0	-	633	-	Qualicum fishery opened to gillnets on Oct 12, 1600 hrs to Oct 14 1600 hrs (including 24 hr extention). Sub-areas open include: 14-4 and 14-5, between a 1 1/2 mile beach boundary and 5 mile outer boundary off Vancouver Is.; 14-7 except a small triangular portion in Tribune Bay (5 mile shore boundary); 14-9 to 14-11, a portion of these areas northeasterly of Comox Bar bounded by a line commencing at Longbeak Pt. in a straight line to Favada Pt. to the intersection of the northeasterly boundary of 14-9 then northeasterly along the 14-9 boundary to Cape Lazo navigation lights then along the shore of Vancouver Is. to a point off Willemar Bluff then 153 degrees true to Longbeak Pt. Beach boundary in effect for chinook conservation. Gillnet mesh size restriction of 149 mm.
24-Oct	-	1.0	-	191	Opened 0800 hrs Oct 21 to seines until 0800 hrs Oct 22. Seine minimum bunt mesh size of 100 mm. Same boundaries as previous week.
31-Oct	1.0	1.2	727	311	Open to gillnets 1600 hrs Oct 25 until 1600 hrs Oct 26. Gillnet mesh size restriction of 149 mm. Open to seines 0800 hrs Oct 28 until 1200 hrs Oct 29. Seine minimum bunt mesh size of 100 mm. Same boundaries for both gears as previous week.

Appendix D (cont.)

Week Ending	Days GN	Days SN	Gear GN	Gear SN	Management Regulations
AREA 14 (con'd)					
07-Nov	-	2.1	-	166	Open to seines 0800 hrs Nov 3 until 1000 hrs Nov 5 (includes 22 hr extention). Seine minimum bunt mesh size of 100 mm. Same boundaries as previous week except 14-4 and 14-5: outside of a 1 mile beach boundary of Vancouver Is. and 1 1/2 mile radius boundary off French Creek.
14-Nov	1.0	-	355	-	Open to gillnets 1600 hrs Nov 9 until 1600 hrs Nov 10. Gillnet mesh size restriction of 149 mm. Same boundaries as previous week including all sub-area 14-7.
AREA 16					
05-Sep	1.0	1.0	88	16	Open to both gillnets and seines at 1800 hrs Sep 1 and closing 1800 hrs Sep 2. Sub-areas open include 16-19 to 16-22 inclusive.
AREA 17					
14-Nov	1.0	-	181	-	Open to gillnets 1600 hrs Nov 9 until 1600 hrs Nov 10. Gillnet mesh size restriction of 149 mm. Sub-areas 17-13 northerly of a line from Batchelor Pt. to a marker at the southerly entrance to Descanso Bay and easterly of a line from Horsewell Bluff true south to a boundary sign on Newcastle Is. Sub-area 17-12 southeasterly of a line from neck Pt. to Five Fingers Is. to Orlebar Pt.
AREA 18					
14-Nov	1.0	-	90	-	Open to gillnets 1600 hrs Nov 9 until 1600 hrs Nov 10. Gillnet mesh size restriction of 149 mm. Sub-areas 18-6 with an eastern boundary in effect from a line commencing at Swartz Head to the south end of Pym Is. then to Canoe Rock then to Beaver Point.

APPENDIX E. REVIEW OF BUTE INLET COMMERCIAL NET FISHERIES, 1970-1987.

BACKGROUND

Bute Inlet is a long narrow coastal fjord adjacent to Johnstone Strait north of Campbell River, and located in the Statistical management Area 13 (Appendix Fig. E-1). Major tributaries to Bute Inlet include the Orford, Homathko and Southgate Rivers (Appendix Fig. E-2). These rivers support the majority of salmon in the area. The Orford River located half way up the east side of Bute Inlet, flows southwest into Orford Bay and has both summer and fall run chum stocks. The Southgate and Homathko Rivers, located at the head of the inlet, have fall run chum stocks only. Characteristically, the summer run fish stocks are considerably larger, averaging 18 pounds (8 kg), compared to the later timed fall chum which average only 13 pounds (6 kg) per fish.

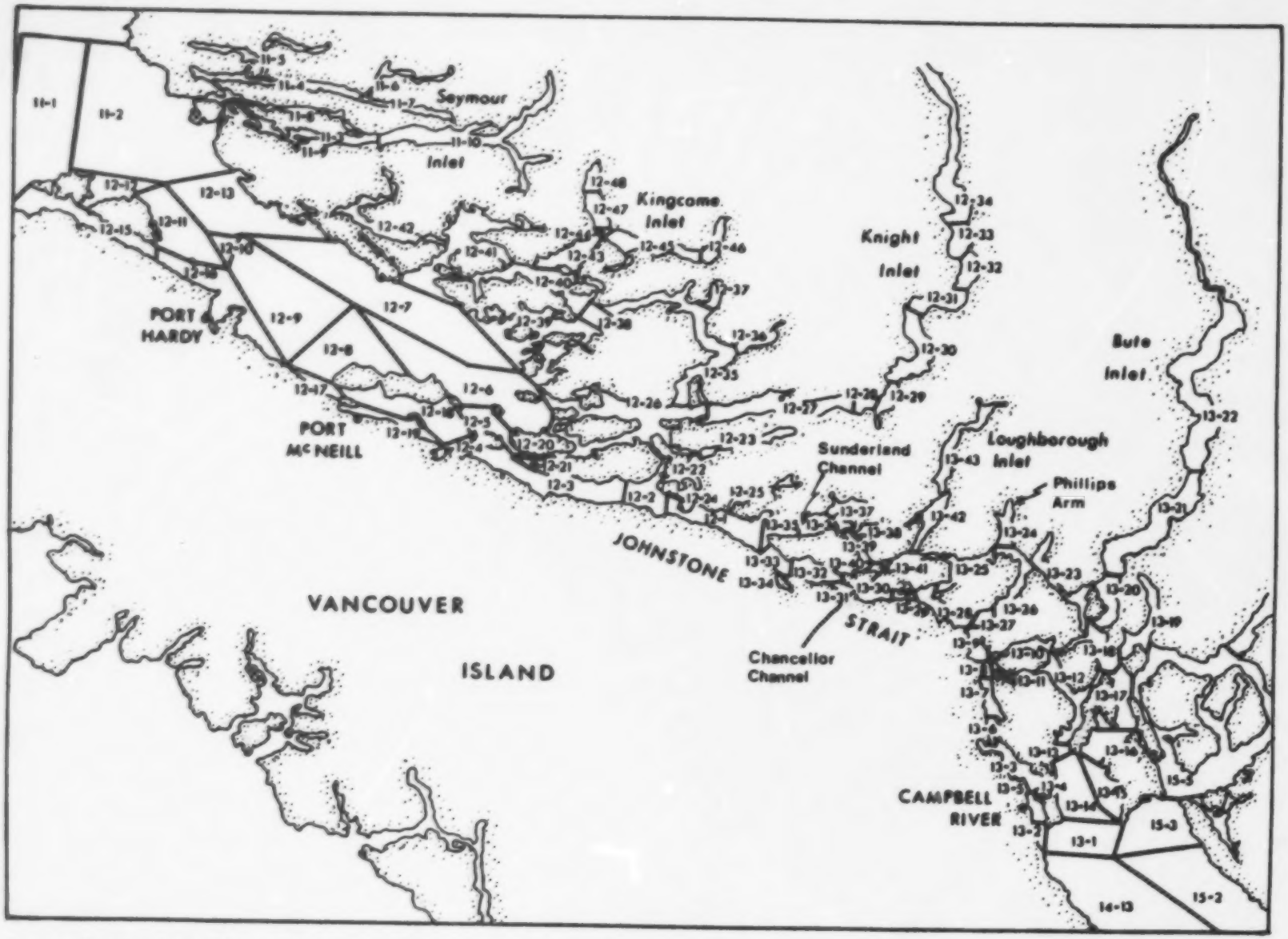
Historically, gillnet fisheries in inlets have targeted upon chum returning to Bute Inlet and to neighbouring Loughborough and Phillips Inlets. Pre-season expectations of Bute Inlet chum are based on brood returns and projected average survivals. In-season stock strength returns are assessed using incidental catches in Sunderland Channel and gillnet test catches in Bute Inlet. In those years when surplus chum stocks are expected to return to the Bute Inlet system, gillnet test fishing is initiated, and subrequent catches identify possible harvestable surpluses. These are harvested terminally within the inlet. Records since 1970 indicate that all Bute Inlet net fisheries have been conducted by gillnets only.

The summer and fall run chum stocks returning to Bute Inlet have a similar migration pattern through Sunderland, Chancellor and other Area 13 mainland inlet channels. The early or summer run chum are first noted as incidental catches in the commercial sockeye and pink fishery during the second and third weeks of August. The fall run chum first appear in the commercial fishery approximately two weeks later and their migration may continue through to December.

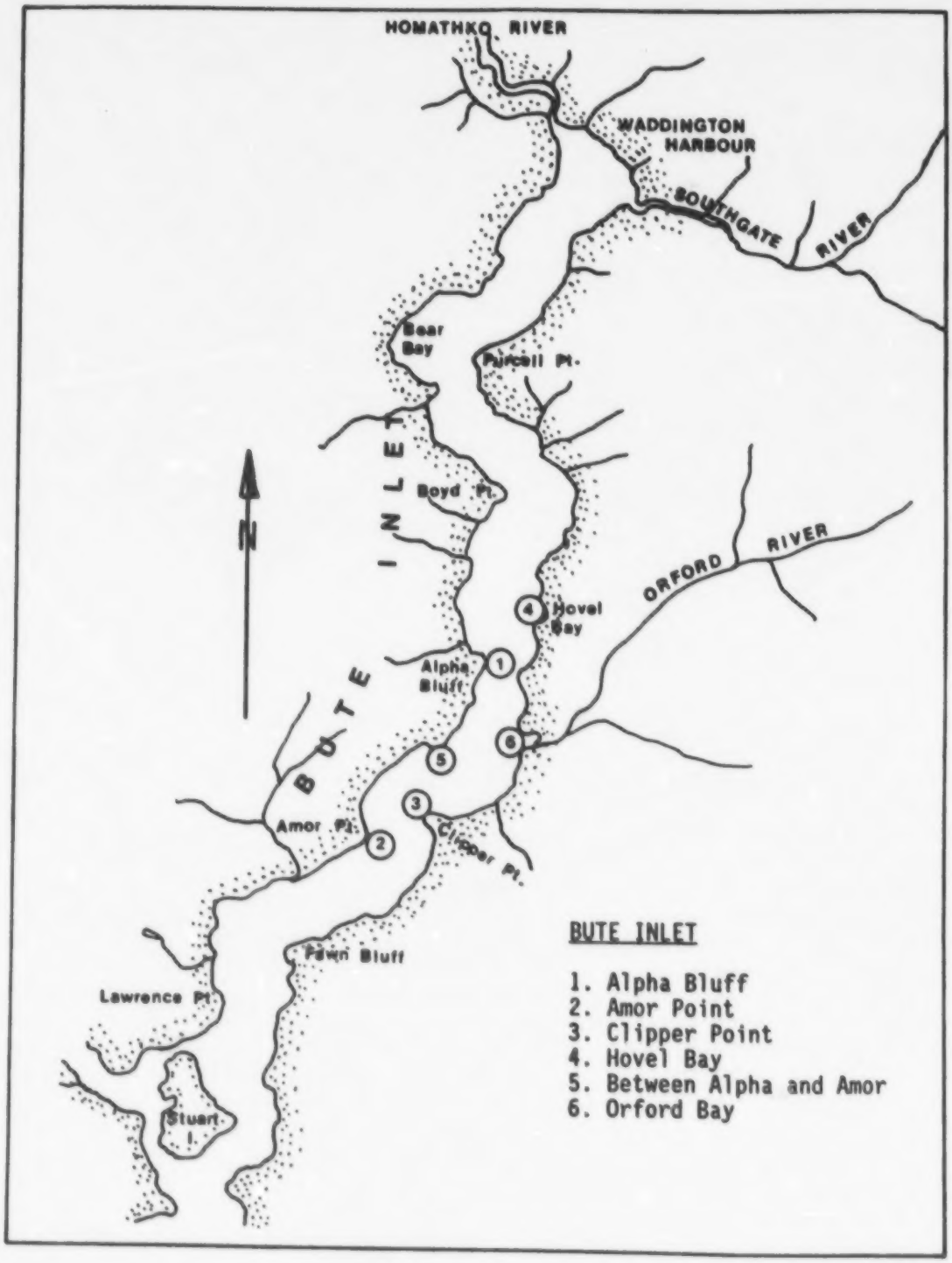
BUTE INLET TEST FISHERY

The Bute Inlet gillnet test fishery usually commences about the first week of August, operating for two days each week during the non-commercial fishing period to assess the returning Orford River summer run chum stock size. In addition, the test fishery provides information on the distribution of passing chinook destined for streams in the upper inlet area. Six predetermined fishing sites in the inlet, four of which are located below Orford River and two above, are used for gillnet test catch comparisons of returning Bute Inlet stocks (Appendix Fig. E-2). Each drift or soak period at each location is usually no longer than 1/2 hour duration.

The test catches provide managers with information regarding chum fish size, distribution, holding area location and direction of migration. Of these four parameters, fish size is used to differentiate between the Orford and Homathko/Southgate stocks. The latter, being fall run fish, are noticeably smaller. Catch distribution data are used to determine fishing boundaries and



Appendix Fig. E-1. Location of Bute Inlet and associated Statistical sub-areas.



Appendix Fig. E-2. Bute Inlet area showing the six test fishing sites.

potential commercial catch quality in the event of an opening. Test catches also provide information on stock migration patterns. Historical data indicate that Homathko/Southgate stocks migrate on the northwest or opposite side of the inlet compared to chum returning to the Orford system. Test fishing information combined with current escapement information and observations in Sunderland and Chancellor Channels, serve to direct possible commercial openings.

BUTE INLET COMMERCIAL FISHERY

Chum catches in the Bute Inlet commercial gillnet fishery are summarized for the period 1970 to 1987 in Appendix Table E-1. Appendix Tables E-2 to E-9, shown at the end of this appendix, detail the weekly fishery openings and durations each year, as well as the weekly gear counts and catches. During the 1980s, the Bute Inlet commercial gillnet fisheries targeting on chum salmon have generally occurred only once every three or four years. These openings were initiated solely upon assessments in Sunderland Channel and gillnet test catches in Bute Inlet. Since 1982, the initial opening has occurred in September in what is referred to as sub-areas 13-20 and 13-21, excluding a box boundary off the mouth of Orford River. These area openings are designed to crop the summer run Orford chum. Any additional openings which sometimes include sub-area 13-22, are primarily targeting on fall run surpluses returning to either the Southgate and/or the Homathko Rivers.

STATISTICAL MANAGEMENT SUB-AREAS

1982-1984 Regulation divisions

In 1982 the regulations regarding the description of management areas were revised and the Pacific Management Areas 1 to 29 initially broken down into sub-areas which are defined as a subdivision of a management area. The numerical divisions for Bute Inlet, enforced by regulation from 1982 to 1984, were different from those enforced today and were as follows:

Sub-area 13-7: Those waters of Bute Inlet and Cordero and Calm Channels bounded on the north by a line true east from Lawrence Point to a boundary marker on the opposite shore; and bounded on the west by lines from Owen Point on the mainland to Hall Point on Sonora Island; and from Springer Point to Etta Point on Maurelle Island; and on the south by a line from a boundary marker on Maurelle Island true east to Mayes Point on Read Island, thence to the north tip of the middle of the three Rendezvous Islands, thence to Raza Point on Raza Island, thence true north to a fishing boundary marker on the mainland.

Sub-area 13-8: Those waters of Bute Inlet bounded on the south by a line from Lawrence Point true east to a fishing boundary marker on the opposite shore; and bounded on the north by a line from Alpha Bluff true east to a fishing boundary sign on the opposite shore.

Sub-area 13-9: Those waters of Bute Inlet lying northerly of a line from Alpha Bluff true east to a fishing boundary marker on the opposite shore.

Appendix Table E-1. Summary of chum catches in the Bute Inlet commercial gillnet fishery, 1970-1987 (years with no data indicate that no commercial fishery occurred).

Year	Chum Catch
1970	-
1971	-
1972	-
1973	29,233
1974	-
1975	7,452
1976	22,642
1977	2,284
1978	18,076
1979	146
1980	-
1981	-
1982	43,934
1983	-
1984	-
1985	-
1986	85,038
1987	-
Average (1)	
All	26,101
Odd	9,779
Even	42,423

(1) Only those years included when fishing occurred.

Post 1984-Regulation Divisions

Under current management regulations (i.e. since 1984), sub-areas 13-20, 13-21 and 13-22 are designated as follows:

Sub-area 13-20: Those waters of Bute Inlet bounded on the south by a line from Johnstone Bluff on the mainland to Harbott Point on Stuart Island; bounded on the north by a line from Lawrence Point to a marker true east on the mainland; and bounded on the west by a line from Turnback Point on Stuart Island true north to the mainland.

Sub-area 13-21: Those waters of Bute Inlet bounded on the south by a line from Lawrence Point true east to a marker on the opposite shore; and bounded on the north by a line from Alpha Bluff true east to a marker on the opposite shore.

Sub-area 13-22: Those waters of Bute Inlet lying northerly of a line from Alpha Bluff true east to a marker on the opposite shore.

For areas designated to be open to commercial fishing in Bute Inlet prior to 1982 refer to Appendix Tables E-2 to E-7.

Appendix Table E-2. Weekly catches in the Bute Inlet commercial gillnet fishery, 1973.

WEEK ENDING DATE		DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
							SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
SEP 15	9/2	6 PM SUN SEP 9 TO 6 PM WED SEP 12	72 HRS	THE APPROACHES TO BUTE IN. N. OF A LINE FROM BASSETT PT. TO JONSTNE.BLUFF IN THE OPEN PORTION OF THE AREA. BUTE IN.OPEN TO GN.ONLY WITH A BOX BNDRY.OFF THE ORFRD R.	39	73	1	865	60	4200	60	
SEP 22	9/3	6 PM SUN SEP 16 TO 6 PM WED SEP 19	72 HRS	" " " " "	70	121	0	1006	11	2059	156	
SEP 29	9/4	6 PM SUN SEP 23 TO 6 PM WED SEP 26	72 HRS	" " " " "	33	84	0	625	7	2733	149	
OCT 5	10/1	6 PM SUN SEP 30 TO 6 PM WED OCT 3	72 HRS	" " " " " "	30	135	0	691	13	8463	123	
OCT 13	10/2	6 PM SUN OCT 7 TO 6 PM WED OCT 10	72 HRS	" " " " "	83	211	8	764	0	11778	132	
		Total	360 HRS			624	9	3951	91	29233	620	

Appendix Table E-3. Weekly catches in the Bute Inlet commercial gillnet fishery, 1975.

WEEK ENDING DATE	DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
						SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
OCT 18 10/3	6 PM MON OCT 13 TO 6 PM TUE OCT 14	24 HRS	THE WATERS OF PURSE SEINE AREA 13 DESCRIBED IN THE P.C. FISHERY REGS. AND INCLUDING THE WATERS OF BUTE IN.&FRWRD HBR.	250/275	227	0	396	0	7452	60	
	Total	24 HRS			227	0	396	0	7452	60	

Appendix Table E-4. Weekly catches in the Bute Inlet commercial gillnet fishery, 1976.

WEEK ENDING DATE		DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
							SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
AUG 7	8/1	6 PM SUN AUG 1 TO 6 PM WED AUG 4	72 HRS	THE WATERS OF PURSE SEINE AR AREA 13,AS DESCRIBED IN THE P.C.FISHERY REGS.AND INCLUDING THE WATERS OF BUTE IN.& FRWRD HBR.		6	0	0	0	243	161	
AUG 14	8/2	6 PM SUN AUG 8 TO 6 PM TUE AUG 10	48 HRS	" " "	5	11	1	11	0	1353	18	
SEP 11	9/2	6 PM SUN SEP 5 TO 6 PM WED SEP 8	72 HRS	THE WATERS OF SALMON SEINE AREA 13,AS DESCRIBED IN THE P.C.FISHERY REGS. & INCLDING THE WATERS OF BUTE IN.,THAT ARE CURRENTLY OPEN TO SALMON NET FISHING.	220/230	466	4	1760	11	20454	57	
SEP 18	9/3	6 PM SUN SEP 12 TO 6 PM TUE SEP 14	48 HRS	" " "	60/75	64	0	137	0	592	24	
		Total	240 HRS			547	5	1908	11	22642	260	

Appendix Table E-5. Weekly catches in the Bute Inlet commercial gillnet fishery, 1977.

WEEK ENDING DATE		DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
							SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
AUG 6	8/1	6 PM SUN JUL 31 TO 6 PM WED AUG 3	72 HRS	THE WATERS OF SALMON PURSE SEINE AREA 13,AS DESCRIBED IN THE P.C.FISHERY REGS.& INCLDING THE WATERS OF BUTE IN.,THAT ARE CURRENTLY OPEN TO SAL.NET FISHING.		10	0	3	5	115	623	
SEP 17	9/3	6 PM SUN SEP 11 TO 6 PM TUE SEP 13	48 HRS	THAT PORTION OF BUTE IN. BOUNDED ON THE SOUTH BY AN IMAGINARY STRAIGHT LINE DRAWN FR LAWRENCE PT. TO A WHITE FISHING BOUNDARY SIGN LOCATED ON THE SHORE OF BUTE IN.IMMEDIATELY OPPOSITE THERETO,& ON THE N.BY A IMAGINARY STRAIGHT LINE DRAWN FR A WHITE FSHNG BNDRY SIGN LOCATED THE SOUTHERLY SHORE OF ORFORD BA ACROSS BUTE IN.IN A WESTERLY DIRECTION TO A WHITE FSHNG BNDRY SIGN LOCATED ON THE OPPOSITE SHO	157	207	6	1000	40	2169	79	
		Total	120 HRS			217	6	1003	45	2284	702	

Appendix Table E-6. Weekly catches in the Bute Inlet commercial gillnet fishery, 1978.

WEEK ENDING DATE		DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
							SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
AUG 5	7/5	6 PM SUN JUL 30 TO 6 PM WED AUG 2	72 HRS	THE WATERS OF PURSE SEINE AREA 13 AS DESCRIBED IN THE P.C.SALM.FSHRY REGS & CONTIGUOUS WATERS INCLUDING THE WATERS OF BUTE IN. & FORWARD HBR.	44	43	0	18	0	1010	546	
AUG 12	8/1	6 PM SUN AUG 6 TO 6 PM TUE AUG 8	48 HRS	" " " " " " "		58	0	52	0	1710	340	
SEP 23	9/3	6 PM SUN SEP 17 TO 6 PM TUE SEP 19	48 HRS	THAT PORTION OF BUTE IN BOUNDED ON THE S. BY AN IMAGINARY STRAIGHT LINE DRAWN FR LAWRENCE PT TO A WHITE BNDRY SIGN LOCATED ON THE SHORE OF BUTE IN. IMMEDIATELY OPPOSITE THERETO,& ON THE N. BY AN IMAGINARY STRAIGHT LINE DRAWN FR ALPHA BLUFF TO A WHITE FSHNG BDRY SIGN LOCATED ON THE SHORE OF BUTE IN. IMMEDIATELY OPPOSITE THERETO.	187	410	15	1741	21801	12487	73	
SEP 30	9/4	6 PM SUN SEP 24 TO 6 PM TUE SEP 26	48 HRS	" " " " " " "		125	0	52	0	2869	38	
		Total	216 HRS			636	15	1863	21801	18076	997	

Appendix Table E-7. Weekly catches in the Bute Inlet commercial gillnet fishery, 1979.

WEEK ENDING DATE	DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
						SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
	6 PM JUL 9 TO 6 AM JUL 11	48 HRS									
JUL 21 7/3	6 PM SUN JUL 15 TO 6 AM WED JUL 17	48 HRS	THE WATERS OF SAL. PURSE SEINE AREA 13 AS DESCRIBED IN THE P.C.SAL.FSHRY REGS & CONTIGUOUS WATERS,INCLUDING THE WATERS OF BUTE IN. & FRWRD HBR. GN & SN SN OPEN JUL 16-18.		9	0	0	0	9	325	
JUL 28 7/4	6 PM SUN JUL 22 TO 6 PM TUE JUL 24	48 HRS	THE WATERS OF SAL. PURSE SEINE AREA 13 AS DESCRIBED IN THE P.C.SAL.FSHRY REGS & CONTIGUOUS WATERS,INCLUDING THE WATERS OF BUTE IN. & FRWRD HBR. GN & SN SN OPEN JUL 23-25.		26	2	8	5	137	853	
	Total	144 HRS			35	2	8	5	146	1178	

Appendix Table E-8. Weekly catches in the Bute Inlet commercial gillnet fishery, 1982.

WEEK ENDING DATE	DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
						SOCKEYE	COHO	PINK	CHUM	CHINOOK	OTHERS
SEP 4 9/1	WED SEP 1(1200) TO THUR SEP 2(1800)	30 HRS	BOUNDED ON THE SOUTH BY A LINE FROM LAWRENCE PT TRUE EAST TO A FISHING BOUNDARY MARKER ON THE OPPOSITE SHORE AND BOUNDED ON THE NORTH BY A LINE FROM CLIPPER PT TRUE WEST TO A BOUNDARY SIGN ON THE OPPOSITE SHORE	54	99	3	401	1	6539	113	
SEP 25 9/4	MON SEP 20(1600) TO TUES SEP 21(1600)	24 HRS	BOUNDED ON THE SOUTH BY A LINE FROM LAWRENCE PT TRUE EAST TO A FISHING BOUNDARY MARKER ON THE OPPOSITE SHORE AND BOUNDED ON THE NORTH BY A LINE FROM CLIPPER PT TRUE WEST TO A BOUNDARY SIGN ON THE OPPOSITE SHORE(13-21) AND BUTE INLET LYING NORTHERY OF THE ABOVE BOUNDARY THE TIDAL WATERS OF HOMATHKO, TEAQUAHAN, AND SOUTHGATE RIVERS ARE CLOSED(SOUTH OF A LINE AT LITTLEJOHN PT DUE EAST.THE ORFORD IS CLOSED(SOUTH OF A LINE FROM THE NORTHWEST ENTRANCE)	254	391	4	340	1	19327	41	
OCT 2 10/1	SUN SEP 26(1600) TO TUES SEP 28(1800)	50 HRS	BOUNDED ON THE SOUTH BY A LINE FROM LAWRENCE PT TRUE EAST TO A FISHING BOUNDARY MARKER ON THE OPPOSITE SHORE AND BOUNDED ON THE NORTH BY A A LINE FROM CLIPPER PT TRUE WEST TO A BOUNDARY SIGN ON THE OPPOSITE SHORE	250	357	8	929	4	18068	42	
OCT 9 10/2	SUN OCT 3(1600) TO MOND OCT 4(1800)	26 HRS	BOUNDED ON THE SOUTH BY A LINE FROM LAWRENCE PT TRUE EAST TO A FISHING BOUNDARY MARKER ON THE OPPOSITE SHORE AND BOUNDED ON THE NORTH BY A A LINE FROM CLIPPER PT TRUE WEST TO A BOUNDARY SIGN ON THE OPPOSITE SHORE								
	Total	130 HRS			847	15	1670	6	43934	196	

Appendix Table E-9. Weekly catches in the Bute Inlet commercial gillnet fishery, 1986.

WEEK ENDING DATE	DATE OF FISHERY	DURATION OF FISHERY	AREAS OPEN	# OF GEAR	DELIVERIES	CATCHES					
						SOCKEYE	COHO	PINK	CHUM	SPRING	OTHERS
SEP 27 9/4	8 AM SEP 22 TO 10PM SEP.22	15 HRS	BUTE SOUTH, A LINE FROM LAWRENCE PT. EAST TO A MARKER ON THE OPPOSITE SHORE,BOUNDED ON THE NORTH BY A LINE FROM ALPHA BLUFF TRUE EAST T A MARKER ON THE OPPOSITE SHORE (13-21).	165					6296		
OCT 4 10/1											
									227		
OCT 11 10/2	4 PM SUN OCT 5 TO 8 AM TUE OCT 9	40 HRS	13-21; THOSE WATERS OF BUTE INLET LYING NORTHERLY OF A LINE FROM ALPHA BLUFF TRUE EAST TO A MARKER ON THE OPPOSITE SHORE (13-22).	58/162					45567		
OCT 18 10/3	4 PM MON OCT 13 TO 8 AM THUR OCT 16	16 HRS	13-21,13-22	177/200					32948		
	Total	71 HRS							85038		

Appendix F. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
UPPER VANC IS											
Cluxewe R	0.5		0.1	0.1	0.1		0.0	0.0	0.2	0.8	3.5
Keogh R	0.0	0.0	0.5					0.0	0.4	2.1	5.0
Nahwitti R	0.0					0.0		0.0	0.1	0.3	1.6
Quatse R	0.1	0.4	0.3	0.3	0.2	0.0		0.0	0.5	5.1	7.8
Songhees					0.0	0.0			0.0	0.1	0.3
Stranby R				0.0		0.0			0.1	0.0	3.6
Sushartie	0.0					0.0			0.0	0.3	0.7
Tsulquate R	0.0	0.5				0.0	0.0		0.2	0.6	1.2
Total	0.6	0.9	0.9	0.4	0.3	0.0	0.0	0.0	1.4	9.3	23.7
KINGCOME INLET											
Bughouse Bay				0.0		0.0	0.0	0.0			0.7
Charles	0.0			0.0	0.0			0.0			0.4
Embly Cr	0.0	0.0	0.0	0.0		0.0	0.0	0.0			6.0
Health Lagoon				0.0	0.0						
Nuaskin	0.0		0.3	0.0	0.0	0.0	0.3	0.3	0.3	0.0	
Jennis Bay		0.1		0.0		0.0		0.0		0.0	
Kenneth R.		0.1		0.0	0.0						
Kingcome R	3.0		0.4	0.3		3.3	0.0	10.0	22.3	11.2	19.1
McKenzie R	0.5	0.3	1.3	4.8	3.5	5.0	6.0	0.6	6.6	2.1	13.5
Nimmo Creek	0.4	0.3	0.5	0.3	0.4	0.3	0.3	0.3	2.4	1.8	5.2
Scott Cove	0.5	0.0	0.2	0.0	0.1	0.9	0.3	0.0	0.1	0.0	0.6
Shelter Bay				0.0	0.0						0.0
Tsibass-Marion	0.1	0.1	3.0	0.4	3.5	4.5	3.8	2.5	3.2	0.4	5.0
Wakeman R	0.6	1.5	0.1	0.3	0.4	0.4	1.0	0.5	5.1	2.5	8.6
TOTAL	5.1	2.3	5.7	6.0	7.9	14.5	11.6	14.1	39.9	18.0	59.0
BOND TO KNIGHT											
Ahta Valley Cr							0.1	0.8	0.3	0.5	8.3
Ahnuhati R *	6.5	50.0	3.0	0.5	7.7	4.0	3.0	12.0	3.6	6.0	21.4
Barnard (Shoal)	0.0			0.0	0.0					0.1	0.0
Boughey Bay						0.0	0.0	0.0		0.1	0.1
Call	0.3	0.2	0.3	0.3	0.6	0.3	0.2	0.3	1.7	0.6	1.4
Carriden Bay Cr				0.0			0.0	0.0			
Cracroft	0.0			0.0	0.0						0.0
Franklin R	0.0			0.0	0.0				0.4	0.9	1.4
Gilford [Fraser]			0.1	0.0	0.1	0.0		0.0	0.1	0.2	0.6
Glendale R	0.4	0.3	0.1	1.5	2.1	2.0	0.3	1.0	9.7	18.9	10.0
Hoeya Sound				0.0			0.0	0.0		0.1	0.6
Kakweiken Chnl											
Kakweiken R	0.3	1.1	0.2	3.0	3.5	5.8	0.8	3.0	4.1	3.2	18.7
Kamano Bay						0.0		0.0			0.2
KlinaKlini R	0.0		0.0	0.0	0.7		0.3	0.0	11.5	9.4	24.9
Kwalate	0.0	0.2	0.2	0.0	0.2	0.2	0.2	0.1	0.1	0.1	0.4
Maple Cove	0.0										0.1
Matsui				0.0				0.2		0.0	0.1
Shoal Hbr Lake	1.1	0.3	1.9	5.0	0.3	0.3	0.3	0.4	1.2	1.8	5.3
Viner Cr	30.0	21.5	40.0	40.0	25.0	48.0	7.5	14.0	27.5	30.6	49.0
Wahshihlas-Sim	0.4	0.6	0.0					0.0	0.0	1.0	2.1
Waterfall-Ahta	0.6	1.2	0.3	0.5	0.3	13.5	0.2	15.0	11.5	9.8	9.5
Total Wild	33.0	25.2	43.0	50.3	32.6	70.0	9.8	34.6	68.1	77.3	132.9
Total Summer *	6.5	50.0	3.0	0.5	7.7	4.0	3.0	12.0	3.6	6.0	21.4

Appendix F cont'd. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
JOHNSTONE STRAIT											
Adam-Eve R				0.0			0.0	0.0	0.1	0.8	3.1
Armour de Cosmos	0.1	0.2	0.1	0.0	0.0	0.0		0.0	0.7	0.4	0.7
Fulmore R	1.2	3.5	6.0	0.3			4.2	0.5	1.2	0.9	2.8
Hyacinth R	0.4	4.0	2.0	7.5	2.0	4.5	2.4	2.5	2.7	1.6	3.8
Hyde									0.1	0.0	
Kokish R		0.0							0.1	0.4	2.0
Mills	0.0	0.3	0.0						0.1	0.2	0.8
Nimpkish R	15.0	90.0	70.0	38.0	7.5	55.0	10.0	14.0	12.7	24.3	58.0
Robbers Nob Cr	0.0			0.0	0.0					0.0	0.0
Salmon R	0.2	0.1				0.1		0.5	0.9	1.5	5.8
Tsitika R			N/O	0.0				0.0	0.1	0.0	1.0
Tuna R.			0.4	0.4		0.3		0.3	0.1	0.1	0.9
Total	16.9	98.1	78.4	46.1	9.5	59.9	16.6	17.8	18.5	30.1	78.9
LOUGHBOROUGH/BUTE											
Apple R		6.0	7.5		0.1			5.0	7.3	1.3	1.5
Bachus					0.0	0.0					
Cameleon Hrb.	0.1	0.1	0.0		0.1		0.1		0.0	0.2	0.2
Chonat	0.0									0.0	0.0
Christie	0.1	0.1		1.2	0.3	0.1	0.5	0.2	0.5	0.7	0.1
Cumsack R				0.0	0.0				0.0	0.3	1.7
Drew Cr.	0.1	0.0			0.1				0.0	0.0	0.1
Elephant					0.1						
Evans	0.1	0.4	1.6	0.8	0.5		0.6	0.4	0.9	0.7	0.3
Fanny Bay	0.0			0.0	0.0				0.0	0.0	0.1
Fraser Bay Cr	0.5	2.0	0.0		0.0	0.1	0.0	0.1	0.3	0.1	0.1
Fredrick Arm	0.0									0.2	0.2
Granite Bay	2.0	1.0	0.1	1.9	1.5	0.3	0.5	0.3	0.3	0.5	0.4
Grassy					0.0			0.0	0.1	0.1	0.0
Gray			0.0		0.0					0.1	0.0
Hanson	0.0			0.0	0.0		3.0	0.1	0.2	0.2	0.2
Henning Lake Sys	0.1		0.2		0.0					0.1	0.2
Heydon R	7.0	10.0	17.0	8.0	3.5	30.0	5.5	1.2	18.8	10.5	6.9
Homathko R	2.5	45.0	1.5	10.0	3.5	50.0	1.3	45.0	20.1	3.3	17.0
Kanish	2.0	0.1	2.3	2.7	0.4	0.0	1.0	0.3	0.4	0.5	0.4
Knox Bay					0.0				0.0	0.1	0.0
Open Bay	0.4	0.8	1.3	2.5	6.0	0.4	5.0	0.1	0.9	1.0	0.7
Orford R *	18.0	110.0	10.0	15.0	20.0	80.0	100.0	50.0	50.6	7.2	10.3
Owen Bay		0.0		0.1	0.0	0.0					
Phillips R	2.0	3.0	4.0	0.5	0.5	2.0	0.0	0.8	4.3	2.6	5.7
Quatam R	0.5	0.5	0.2		0.0		1.2	3.5	2.6	1.2	3.1
Read	0.0		0.8		0.1	1.0	0.2	0.2	0.7	1.0	0.6
Southgate R	77.0	250.0	75.0	95.0	80.0	150.0	125.0	100.0	36.2	6.7	8.2
Stafford	0.5	1.0	1.0		0.0			0.3	1.2	1.4	1.2
Swansky	0.0			0.0	0.0	0.0	0.0	0.0			0.0
Teaquahan	0.0	3.0			0.0			0.0	0.0	0.4	1.2
Thurston	0.1	0.2	0.4		0.2	0.2	1.0	0.1	0.2	0.4	0.2
Village Bay Cr	0.2	0.9		0.3	5.0	3.0	3.5	4.2	1.7	1.1	3.5
Waiatt	0.0	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
White Rock Pass	0.0	0.1	0.3	0.1	0.2		0.2	0.2	0.2	0.1	0.2
Wortley	0.6	1.1	4.0	1.6		0.1	2.0	1.5	0.2	0.3	0.2
Total Fall	95.8	295.4	117.3	124.8	102.2	237.3	150.5	163.4	97.3	35.0	54.4
Total Summer *	18.0	110.0	10.0	15.0	20.0	80.0	100.0	50.0	50.6	7.2	10.3

Appendix F cont'd. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
MID VANC IS											
Big Qualicum(+ Brood Stock)	72.8	124.6	105.7	92.2	130.0	116.0	82.0	93.2	113.3	55.5	41.0
Black	0.0			0.0	0.0	0.0	0.0	0.0			
Bob		0.1									
Brooklyn	0.0			0.0	0.0	0.0	0.0				
Campbell	3.5	7.5	8.7	4.0	0.6	0.8	2.0	6.0	4.8	1.3	2.4
Cook Cr (Chef)	0.7	1.0	7.1	1.6	0.0	0.0	0.1	0.2	0.0	0.1	1.9
Cougar-Cowie			0.3	0.2	1.2	0.1	0.6	1.1	0.3	0.8	3.6
Deep Bay (Cabin)								0.3			
Englishman R	0.6	2.0	2.0	2.5	0.2	2.5	0.4	1.0	4.8	3.6	8.1
French Cr	0.0		0.5		0.0	0.0	0.0	0.1	0.5	0.5	0.8
Hart			0.0			0.0	0.0	0.0	0.0		
Kingfisher				0.0		0.0					
Kitty Coleman	0.0			0.0	0.0	0.0	0.0	0.0	0.0		
L Qualicum R	45.0	75.0	85.0	70.0	55.0	70.0	30.0	60.0	53.7	42.5	43.0
LQR Chnl	50.2	46.8	67.6	43.4	31.0	28.7					
Lynn (Chef)	0.0		0.1	0.0		0.0					
McNaughton Cr	0.1	0.3	0.3	0.5	5.5	0.6	2.1	0.7	1.9	0.9	4.8
Menzies	0.0	0.1	0.7	0.1	0.1	0.0	0.0	0.1	0.2	0.4	0.6
Millard (Lard)	0.0	0.0	0.0	0.0	0.0	0.0	0.3				
Mohun	0.0	0.0	3.0	1.2	0.6	0.1	0.2		0.2	0.2	0.5
Morrison Ck.	0.2	0.8	0.5	0.5				0.0			0.1
Mile R	0.0	0.5	0.1		0.1	0.0	0.1	0.0	0.1	0.1	0.3
Oyster R	0.0	0.3	0.1			0.1	0.1	0.2	0.5	0.5	5.3
Puntledge R	47.5	60.0	85.0	40.0	75.0	75.0	82.0	20.0	40.6	34.3	33.0
PUNT.(Brood Stock)	3.7	9.7	6.2	9.6	2.8						
Pye		0.3	0.1		0.2				0.0	0.1	0.1
Quinsam	1.0	0.4	0.0	0.5	0.0	0.2	2.0	0.5	0.7	0.5	1.7
Rosewall Cr			1.4	0.5	2.0	0.6	1.8	5.0	1.1	1.8	3.3
Roy	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Simms	0.0			0.0	0.0	0.0	0.0	0.0			
Trent	0.1	0.0	0.2	0.1	1.5	0.1	1.0	1.0	0.9	0.2	
Tsable R	0.5		1.0	2.0	2.0	1.2	8.6	6.2	5.0	6.5	7.9
Tsolum R	0.1	0.4	0.2	0.1	11.0	0.3	11.0	7.0	0.1	0.8	0.6
Waterloo Cr	0.0		0.1		0.2	0.1	0.5	0.5	0.4	0.6	1.6
Wilfred-Coal	0.2	0.4	0.3	0.1	0.7	0.1	1.5	1.4	1.0	0.9	1.3
Total wild	99.6	149.0	196.5	123.8	155.7	151.8	144.2	111.3	116.8	96.4	121.0
Total enhanced	126.7	181.1	179.5	145.2	163.8	144.7	82.0	93.2	113.3	55.5	41.0
TOBA INLET											
Brem Cr + Brem Cr Trib		0.2		0.0	0.1		0.0		1.3	1.5	4.4
Forbes Cr + F.Bay Cr.	4.5	0.2	0.4	0.2	0.5		1.4	0.6	1.2	0.7	5.6
Klite R	0.8	0.1		0.6	0.1	0.4	1.0		1.1	2.5	3.7
Little Toba R	1.5			M/O		2.5	2.0	1.5	1.9	2.6	1.3
Okeover R	3.0	1.4	6.5	7.2	4.5	5.1	7.2	3.0	2.1	0.8	1.9
Pendrell	0.2			0.6			0.4	0.2	0.1	0.3	0.3
Refuge Lagoon				0.0					0.0	0.1	0.1
Salt Lagoon Cr									0.0	0.1	0.8
Store			1.0						0.1		
Tahumming R.									0.0	0.1	0.2
Theodosia R	0.3	2.3	3.5	3.0	2.5	2.0	4.5	1.0	3.8	5.9	17.6
Toba R	0.0	0.2	0.0	8.0	10.0	2.5	0.0		4.8	7.3	34.2
Total	10.3	4.4	11.4	19.6	17.7	12.5	16.5	6.3	16.5	21.7	69.9

Appendix F cont'd. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
JERVIS INLET											
Angus-Pete	1.0	1.5	2.4	3.0	0.6	0.5	1.6	1.6	1.1	2.6	1.3
Baker	0.0	0.0	0.1		0.1	0.0	0.1		0.2		
Britain R	0.5	0.4	0.3	0.1	0.2	0.1	0.2	0.5	0.2	0.7	1.4
Burnett	0.1	0.2	0.4	0.4	0.0	0.0	0.1	0.1	0.0		
Chamberl-Carlson	0.3	0.3	1.5	0.6	0.4	0.4	1.0	0.6	0.4	1.4	0.5
Dayton	0.2	0.1	0.3	0.4	1.2	0.2	1.5	1.4	0.8	0.4	0.2
Deserted R	25.0	20.0	25.0	15.0	7.0	10.0	15.0	20.0	18.5	6.1	10.6
Doriston	0.3	0.2	1.1	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1
Earle-Emmerson			0.4					0.2	0.2		
Gray-Shannon Cr	0.4	0.0	0.2	0.2	0.2	0.4	0.6	0.3	0.5	0.7	3.8
Halfmoon	0.0	0.0	0.1	0.4			0.1	0.1	0.1		
High Cr	0.0							0.1			
Hunaechin		1.0									
Kelly	0.0	0.7	3.2	7.5	2.6	1.0	0.3	1.4	0.9	0.2	0.5
Lois	0.6	0.1	0.5	0.5	0.6	0.8	0.8	0.3	0.2	0.2	0.3
Mill			0.0								
Mouat Bay Cr			0.9	0.1					0.4	6.0	
Myrtle	0.3	0.1	0.3	0.7	2.5	0.2	0.4	0.5	0.5	0.4	0.4
Pender Hbr Cr's **	12.1	5.6	17.0	17.2	10.0	1.3	3.2	5.4	7.8	3.5	4.7
Sakinaw Lake Cr				0.1	0.1	0.0	0.1	0.1	0.2	0.9	1.7
Saltery Bay-Bishop Cr	5.9	2.2	7.5	8.5	10.0	2.2	15.0	25.0	11.9	12.6	4.5
Sechelt	0.0					0.0	0.1	0.1	0.0	0.1	0.5
Skwawka R	15.0	15.0	11.0	2.0	2.0	1.2	3.0	2.0	2.3	1.4	1.5
Sliammon R	9.0	25.5	45.0	28.0	16.0	8.0	12.0	11.0	7.2	4.8	13.3
Snake Cr	3.0	1.2	0.9	1.5	0.4	0.1	1.6	0.5	0.2	0.8	1.1
Storm Bay Cr	2.0	0.4	5.0	2.3	0.4	0.8	2.5	2.2	0.3	0.2	0.4
Thunder-Jefferd	1.1	1.0	0.9	2.5	1.7	0.3	2.9	2.3	1.1	0.2	1.1
Tsuahdi	0.3		0.2	0.1	0.0	0.0	0.2				
Tzoonie R	25.0	10.2	30.0	20.0	12.0	19.5	23.0	20.0	11.2	14.5	17.0
Vancouver R	2.0	2.0	3.0	1.2	0.2	0.1	2.0	2.5	2.1	1.4	4.1
West Cr	0.0		1.0	0.1	0.3	0.1	0.1	0.8	0.4		
Whittal	3.7	2.5	4.5	6.5	4.5	2.2	2.5	3.8	1.4	0.4	0.3
Wolfson-Lang Cr	3.0	1.5	3.2	3.5	0.3	1.0	3.0	2.5	2.0	2.8	5.6
Total	110.6	91.6	185.6	122.4	73.6	50.3	82.7	105.4	72.3	62.2	74.8

Appendix F cont'd. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
SOUTHERN VANC IS											
Ayum	0.3	0.3	1.5	1.0	1.5	1.0	4.0	2.0	2.3	0.7	2.2
Chemainus R	20.0	12.0	40.0	35.0	25.0	43.6	22.7	15.0	13.2	9.2	37.6
Colquitz	0.0			0.0	0.0	0.0	0.0	0.0	0.0		
Cowichan	175.0	70.0	190.0	75.0	70.0	110.0	70.0	110.0	63.1	55.6	59.0
Craigflower	0.0			0.0	0.0	0.0	0.0	0.0			
Fulford	0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Goldstream R	53.0	42.0	16.5	21.0	14.0	16.0	32.0	26.0	7.6	7.0	13.3
Koksilah R	8.0	5.0	8.0	7.0	5.0	2.0	2.0	3.5	4.4	5.3	2.3
Sandhill	0.0			0.0							
Shawnigan	0.0			0.0	0.0	0.0	0.0		0.0	0.1	
Total	256.3	129.3	256.0	139.0	115.5	172.6	130.7	156.5	90.5	77.8	114.4
LOWER VANC IS											
Beck	0.0				0.0	0.0	0.0		0.0		
Bloods	0.0	0.0			0.0	0.0	0.0	0.0		0.0	0.0
Bonnell Cr	0.1	0.1	18.9	8.6	1.6	4.3	5.1	2.5	2.9	2.2	7.0
Bonsall Cr	1.0	0.1	0.3	0.3	0.5	0.9	0.1	1.2	0.8	0.2	0.8
Bush Cr	3.0	1.1	5.6	10.5	3.1	2.7	1.3	1.3	2.4	2.3	5.4
Chase	0.2	0.1	0.4	0.0	0.1	1.0	0.4	0.0	0.1		
Departure Bay	0.1	0.0			0.0		0.0	0.0	0.0	0.0	0.0
Haslam	1.5	0.8		3.0	1.4	18.8	3.5				
Holden	0.0				0.0						
Holland Cr	2.0	1.5	10.5	8.5	8.0	3.8	1.2	1.4	2.9	4.6	7.0
Knarston	0.0	0.0			0.0		0.0	0.0	0.0	0.0	
Millstone	0.1	0.1	0.0		0.0		0.0				
Nanaimo R	58.0	27.0	50.0	42.0	46.4	50.0	35.0	50.0	35.1	20.1	48.8
Nanoose Cr	0.8	1.4	4.8	7.0	6.0	1.7	2.3	3.0	5.0	1.0	2.3
Porters	0.0				0.0			0.0	0.0	0.0	0.1
Rocky				0.0	0.0		0.0	0.0	0.0	0.1	0.1
Stocking Lake Cr	0.9	1.2	5.0	8.7	4.6	1.9	2.7	3.0	3.0	1.7	3.6
Walkers Cr	0.4	0.1	0.2	1.2	1.3	0.9	0.4	0.6	0.5	0.3	1.6
Total	68.1	33.4	95.6	89.7	72.9	85.9	52.0	63.1	53.8	32.6	76.5

Appendix F cont'd. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
HOWE SD & SUNSHINE											
28 Mile Cr			0.0				0.0	0.0			
37 Mile Cr				0.0	0.0	0.0		0.0	0.0		
Archies (Twin)			0.0	0.0					0.1		
Ashlu											
Avalon			0.0	0.0					0.1		
BC Rail Ch	1.1	1.0	1.5								
Brohm	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Chapman Cr	0.8	1.1	0.3	0.2	0.4	0.0	0.6	0.5	1.8	0.1	
Chaster	0.0	0.1	0.2	0.5	0.2	0.0	0.1	0.1	0.1		
Cheakamus R	22.0	105.0	130.0	50.0	20.0	20.0	40.0	60.0	34.0	19.3	19.8
Chuck Chuck	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0		
Dakota	0.1	0.1	0.0	0.0	0.0				0.0		
Dryden	0.3	0.4	0.1	0.0							
Flume					0.0		0.0	0.0	0.0		
Garden Bay***											
Hop Ranch	0.0		0.0	0.0		0.1	0.1	0.0			
Judd Slough	2.0	1.0	12.0	7.0							
Langdale	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.1		
Long Bay	1.2	0.3	5.4	3.9	2.1	0.5	2.0	1.5	1.8	1.0	
Mamquam Ch.	3.5	2.8	6.0	2.0							
Mamquam R	8.5	18.0	25.0	15.0	5.0	6.0	5.0	12.0	19.7	2.8	3.6
Mannion	0.8	0.2	0.4	0.4	0.4	0.1	0.3	0.2	0.3	0.5	
Mashiter	0.2		0.0	0.0	0.0	0.1	0.0		0.0		
Mashiter Chan	2.0										
McNab Cr	0.2	0.5	1.2	2.0	0.3	0.5	1.5	1.2	0.6	0.2	0.3
McNair		0.0	0.0	0.1					0.0		
Meighan	0.0	0.0	0.0	0.2			0.0	0.0			
Moody Ch.***											
Nelson	0.0	0.0					0.0	0.0	0.0		0.2
Ouellette	0.2	0.3	1.5	0.8	0.1	0.0	0.1	0.2	1.4	0.9	
Paradise Ch(upp.+lo.)	4.3	7.5	16.5	4.0							
Pilchuck	0.0		0.0	0.0	0.0	0.1	0.3	0.6	0.2	0.0	0.2
Potlatch				0.0	0.1				0.2		
Rainy	0.1	0.2	0.0	0.1		0.0			0.0		
Roberts Cr	0.2	1.0	2.0	6.5	1.5	0.1	0.2	1.2	1.2	1.3	
Shovelnose	0.0		0.0	0.0	0.1	0.4	1.2	1.5	1.0		
Spring	0.0		0.4	1.0	4.0	4.5					
Squamish R	18.3	80.0	160.0	50.0	50.0	100.0	75.0	150.0	63.5	16.8	44.3
Stawamus	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Tenderfoot	0.3	0.3	5.0	10.0	0.1	0.8	2.0	1.2			
Tiempo Spawn											
Wakefield Cr	0.0	0.0	0.2	0.6	0.3		0.1	0.2	0.5		0.2
West Bay Cr	2.8	0.2	0.7	0.3	1.5	0.5	1.5	0.9	1.3	0.4	
Whispering			0.1			0.0					
Williamson		0.0	0.4	0.7	0.0	0.0	0.0	0.1	1.1	0.7	
Wilson Cr	0.4	0.5	0.4	0.5	0.4	0.0	0.1	0.3	0.1		
Total	69.1	220.5	369.6	155.8	86.5	133.8	130.1	231.5	129.3	43.8	68.7

Appendix F cont'd. Escapement of fall run Study Area chum salmon by system, in thousands.

Sub-area/River	1987	1986	1985	1984	1983	1982	1981	1980	70-79 AVG	60-69 AVG	50-59 AVG
BURRARD INLET											
Brothers	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.0		
Capilano	0.2	0.3	0.1	0.2	0.5	0.1	0.4	0.2	0.5	0.1	0.8
Cypress	-	-	-	-	-	-	-	-			
Hastings	0.0	0.0	-	-	-	-	-	-			
Indian R	31.0	32.0	30.0	30.0	26.0	24.0	17.5	15.0	16.4	5.9	16.9
Lynn	0.0	0.0	0.0	0.0	0.0	-	0.0	-	0.0	0.0	0.1
Maplewood	0.0	0.0	0.0	0.0	-	-	-	-			
McCartney	-	0.0	-	-	-	-	-	-			
McKay	0.0	-	0.0	-	-	-	0.0	0.0	0.0		
Mosquito	-	-	-	-	-	-	-	-			
Mossom	0.4	-	0.3	0.1	-	-	-	-			
Noons	-	-	-	-	-	-	-	-			
Richards	-	-	-	-	-	-	-	-			
Rogers	-	-	-	-	-	-	-	-			
Seymour	6.8	0.4	0.2	0.6	0.5	0.2	0.8	0.3	0.1	0.0	0.7
Westview	-	-	-	-	-	-	-	-			
Total	38.4	32.7	30.6	31.0	27.1	24.4	18.9	15.5	17.1	6.0	18.4
FRASER RIVER											
HW to Douglas		135.0	185.9	31.0	20.5	25.2	23.4	13.2	11.6	2.6	8.7
Douglas to Miss	Not	322.4	375.4	29.4	42.1	28.1	42.1	24.6	52.0	46.6	7.3
Hatzic Slough	Avail-	0.5	1.4	11.1	7.1	2.2	4.0	2.7	1.0	0.4	0.6
Nicomen Slough	able	279.0	501.0	31.5	9.8	12.3	25.2	14.5	10.9	4.3	3.9
Harrison Lake	(1)	5.6	7.4	3	10	18	1	0	0.2	0.3	0.4
Harrison River		30.0	10.0	309.5	230.4	156.3	235.5	158.7	182.8	124.6	67.1
Vedder-Chwk		8.9	15.1	102.7	39.9	71.0	93.2	94.0	75.7	70.5	26.6
Chwk to Hope		14.6	17.6	4.9	2.1	1.7	1.4	0.8	1.5	1.0	1.2
Above Hope		6.2	7.8	0.3	0.0	0.0	0.1	N/A		0.0	
Mainstem Fraser		0.0	0.6	9.6	3.0	5.0	9.8	3.5	3.3	69.5	
Miscellaneous				0.0	0.0	0.0	0.0	0.0			
Total wild	431.0	802.0	1122.2	533.0	365.0	320.3	435.3	312.1	339.1	319.8	115.8
Total enhanced	44.9	31.6	25.5	7.3	2.4	2.0	0.0	0.1			
BOUNDARY BAY											
L Campbell R	0.2	0.3	0.3	0.8	0.4	0.2	0.1	0.2	0.2	0.0	0.4
Nicomekl R	0.0	0.0	-	-	-	-	-	-			
Serpentine R	0.0	0.0	-	-	-	-	-	-			
Total	0.2	0.3	0.3	0.8	0.4	0.2	0.1	0.2	0.2	0.0	0.4
GRAND TOTAL (2)	1406.2	2097.7	2698.2	1595.2	1232.9	1480.0	1291 1	1325.1	1174.0	885.4	1049.8

* Summer run stocks (Ahnuhati in Knight Inlet and Orford in Bute Inlet) not included.

** Pender Harbour Creeks in Jervis Inlet include Meyers, Klein and Anderson Creeks.

*** Areas or data not located (BC 16's missing).

(1) Fraser River total for 1987 based on test fishing data (431,000 wild) and hatchery escapement data (44,900 enhanced). Escapement data for individual rivers not available that year.

(2) Grand total inlcudes all wild and enhanced stocks, less summer run stocks (Ahnuhati and Orford Rivers).